COPYRIGHT, PATENT, AND TRADE SECRET

PROTECTION OF SOFTWARE

THESIS

Richard A. Magnan
Captain, USAF

AFIT/GCS/ENG/86J-6

OCT 2 1986

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY ·
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THESIS

Presented to the Faculty of the School of Engineering

of the Air Force Institute of Technology

Air University

in Partial Fulfillment of the

Requirements for the Degree of

Master of Science

QUALITY
INSPECTED
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Preface

The purpose of this ~~study~~ _thesis_ is to evaluate the legal methods available for protecting proprietary rights in software. Copyright, patent, and trade secret law have been used to protect different types of material and are now being used to protect software. This investigation examines what protection is available and how it protects the software developer's investment. Special emphasis is placed on Air Force software procurement, _and retention of software rights._

Statutes and court cases are reviewed to determine the legislative and judicial views of the copyright, patent, and trade secret protection available for software. Of particular interest was the handling of software technical issues by the nontechnically trained judges and attorneys.

I am grateful to my thesis committee members Dr. Lamont, Dr. Muller, and Major Woffendon for their guidance and support. I owe a special debt of gratitude to Dr. Lamont and numerous other people in the School of Engineering and AFIT Headquarters for their support in allowing me to attend the University of Dayton School of Law. Finally, I wish to thank my wife Peggy for her patience and support.

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COPYRIGHT, PATENT, AND TRADE SECRET PROTECTION OF SOFTWARE

I. Introduction

Background

In a March, 1984 memorandum to the USAF Chief of Staff, the Secretary of the Air Force emphasized the need to obtain data rights to the proprietary computer software products the Air Force procures. If data rights are not obtained, proprietary software may only be used on the computer(s) and by the person/agency specified in the procurement contract. Any use beyond that specified in the contract must be re-negotiated, usually at additional cost to the Air Force.

This situation arose from uncertainty in the legal profession as to the applicability of patent, copyright, and trade secret law to computer software. Some recent court cases have held that some forms of computer software cannot be copyrighted Data Cash Systems, Inc. v. JS&A Group, Inc., 480 F. Supp. 1063 (N.D. Ill. 1979), while other cases have held that it can be copyrighted, Apple Computer, Inc. v. Franklin Computer Corp., 714 F.2d 1240 (3d Cir. 1983). Similar decisions exist for patent cases, Parker v. Flook, 98 S. Ct. 2522 (1978) (not patentable); Diamond v. Diehr, 101 S. Ct. 1048 (1981) (patentable).

Congress established the applicability of copyright protection to software but continues to ignore Supreme Court requests (see Parker v. Flook, 437 U.S. 584, 595 (1978); Diamond v. Diehr, 450 U.S. 175, 216-17 (1981)) for guidance concerning software patents. The Copyright Act of 1976 and its 1980 amendment, 17 U.S.C. sections 101, 117, extended copyright protection to computer software. However, the legal community is still debating what software is covered by it and the extent to which it is covered.

The introduction of the microprocessor in the form of word processors and personal computers has required that more Air Force personnel work with computers and has increased procurement of commercially developed software. Large Air Force data processing installations lease and purchase operating system and applications software. Weapon systems may have embedded software that is commercially developed. Word processors and microcomputers are being procured for office use.

Often, the Air Force needs to modify, or have other vendors (non-original vendor) use, modify, or extend commercially developed software. The issue of legal software rights must be solved because the original vendors often include a proprietary software module in a system of programs developed for the Air Force. As shown in Appendix

F, the Air Force has proprietary rights to the modules
developed with its funds. However, off-the-shelf modules
(developed with the vendors funds) remain the property of
the vendor. If off-the-shelf modules are critical for
system operation (as they usually are) the data rights for
the entire system depend on the vendors control of the
proprietary modules. If the Air Force could develop
replacement modules the system would no longer be tied to
vendor proprietary software. Obviously the replacement
module must perform the same algorithm as the original
module. Is it legal to create a replacement module using
the structure and function of the original module? How
different must the new module be to avoid infringement?
Without answers to these questions, the Air Force must
negotiate with the original vendor for modifications and
extensions. This usually requires additional monies.

Problem

The problem investigated in this study is the
determination of the 'state of the law' in copyrights,
patents, and trade secrets as it pertains to computer
software. What protection is available and what does it
protect? How can the Air Force best use this protection?

Scope

Patent, copyright, and trade secret laws are examined for their applicability to software. Recent court cases are analyzed to determine how the court interprets the statutes and how the court views software. Recommendations for improving the Air Force's acquisition and retention of software data rights are included.

This study is limited to the laws that directly apply to the legal rights of the owner/inventor of software and their customer. The legal foundation and precedents for patent, copyright, and trade secret law, and the requirements for obtaining copyright, patent, and trade secret protection are covered. This study recommends changes to the legal system based on deficiencies in handling computer software based upon legal and technical computer science issues.

This analysis does not address hardware or other legal doctrines applicable to software. Among the other legal doctrines are contract law, tort law, and criminal law. Contract law and the Uniform Commercial Code govern contracts (i.e., employment contracts and warranties) and remedies for breach of contract. Tort law governs liability for malpractice and software failures. Criminal law governs computer crime (i.e., illegal access, use, or taking of computer resources). Gemignani (10), Mandell

(15), Nietzke (20), Scott (24), and Soma (25) cover these topics.

Assumption

The copyright laws were revised in 1976, implemented in 1978, and amended in 1980. The revised copyright laws are be the chronological starting point for this study.

Gemignani (10:31-84) gives several definitions of software and Caswell (5) suggests methods of classifying software. For purposes of this study software is defined as "a set of statements or instructions to be used directly or indirectly in a computer in order to bring about a certain result." 17 U.S.C. section 101.

General Approach

1. Current technical literature covering the legal protection of software is examined to obtain general knowledge of the applicable laws and the current legal practice.

2. Legal publications on the subject are examined for expert viewpoints and case citations.

3. Cases are examined to compile legal precedents and to determine how the court defines and evaluates software.

4. Judicial opinions are examined to determine
   (subjectively) if the court's application of the law
   is "technically correct"

Sequence of Presentation

The report addresses copyrights, patents, and trade secrets in separate chapters. Each chapter begins with pertinent reference facts and the applicable court case issues and holdings. Each chapter concludes with an evaluation of the availability of protection for software under that form of protection. The results chapter discusses current industry practices in protecting software, the Federal Acquisition Regulations that pertain to Air Force procurement of computer software, and recommendations for improving the legal methods of protecting software. The appendices contain judicial opinions for each type of protection, a diagram illustrating the protection available for Air Force software, a description of the U.S. court system, a table of the cases covered in this study, and a glossary of legal terms.

Presumptions

The author's experiences in procuring software, maintaining licence agreements, working with computer professionals, and legal education have shown that the law as it pertains to the protection of software is not easily accessible or understood by computer professionals and their customers. There are two separate and sometimes contradictory forms of law that must be understood. Statutory law is the law as enacted by the legislature. Precedent law is the result of a court applying the statutes to a particular fact situation. When applying the statutes, the court must determine which statutes apply and how they apply. Statutes must be interpreted to determine their application to a particular fact situation. The court must determine the intent of the statute before determining if the statute applies to the situation. Precedent law illustrates the interpretation and application of a law to a specific fact situation.

This investigation explains the legal requirements for protection and the protection available under the copyright, patent, and trade secret laws. The copyright, patent, and trade secret statutes applicable to software are explained. The court's interpretation and application of these statutes is described through the examination of court cases. Current industry practices in protecting software are summarized and recommendations for obtaining

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and protecting legal rights in software procured by the Air Force are given.

Prerequisite Knowledge

This work is mainly written for computer professionals. The reader is assumed to be familiar with software engineering, programming, and basic computer architecture. The report follows the guidelines of technical writing except when referencing legal works or court cases. In those instances, the Uniform System of Citation (1) has been adapted to fit with the technical writing style. The level of the court is indicated in the case citation. Trial court (District Court) cases are identified by F. Supp., Courts of Appeals cases are identified by F.2d, and Supreme Court cases are identified by S. Ct. An explanation of the legal citation system is given in Appendix 1 of Gemignani (10:177-182). Jacobstein (13) and Teply (27) describe the legal research system and explain its use. Only federal court cases are discussed in the report. All copyright and patent cases must be heard in federal court (28 U.S.C. section 1338). Trade secret cases may be heard in either state or federal court. The court system hierarchy is illustrated in Appendix G. The routes of appeals from District Courts to the Supreme Court are illustrated in Appendix H.

Disclaimer

This work is not to be used as a basis for legal action. As is illustrated in the copyright and patent chapters, the law is consistently changing through legislative action and judicial decisions. The information presented here is intended to provide an understanding of the legal system of protecting software. However, it is not a substitute for professional legal counsel. Scott (24), Soma (25), Miller (16), and Mandell (15) provide additional information.

II. COPYRIGHT PROTECTION

INTRODUCTION

This chapter describes the copyright protection available for computer software. The chapter begins with a discussion of copyright law, then important copyright cases are described. The chapter closes with an analysis and evaluation of the protection available to computer software under copyright law.

BACKGROUND

Article I, section 8 of the U.S. Constitution states: "the Congress shall have Power . . . To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries." This clause is called the patent and copyright clause. It gives Congress the power to enact any legislation, consistent with the intent of the Constitution, for purposes of providing copyright protection for limited times. There is no requirement that this power be exercised. An author does not have any claim for protection that does not appear in the Copyright Act itself 17:280). The first copyright statute was enacted in 1790. Major revisions were enacted in 1831, 1870, 1909, and 1976 (17:281). The current

copyright statutes are contained in Title 17, United States Code.

The 1976 Copyright Act preserved the status quo of the protection provided to computer programs under the 1909 act, pending publication of the final report of the National Commission on New Technological Uses of Copyrighted Works (CONTU). The CONTU final report contained three recommendations that were included in the 1980 Copyright Act amendment: computer programs are copyrightable, the Act applies to all computer uses of copyrighted programs, and owners of copyrighted programs who do not own the copyright are allowed to copy those programs to the extent necessary to use them effectively (17:306-307).

The 1980 amendment added to section 101, the following definition of a computer program: "A 'computer program' is a set of statements or instructions to be used directly or indirectly in a computer in order to bring about a certain result." (24:3.11). This amendment also replaced the section 117 'status quo' provision with a section titled "Limitations on exclusive rights: Computer programs" (24:3.12). The new section 117 permits the creation of copies of the work for archival purposes and for the occasions that the creation of a copy is an essential step in the use of the computer program in conjunction with a

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machine (i.e., the creation of a copy of the program when it is loaded into primary memory for execution) (24:3.12).

The 1976 Copyright Act states that copyright protection "subsists . . . in original works of authorship fixed in any tangible medium of expression, now known or later developed from which it can be perceived, reproduced, or otherwise communicated, either directly or by means of any machine or device now known or later developed" (17:295; 24:3.34). Copyright protection is automatic at the moment of fixation in a tangible form (17:280). A work is fixed "when its embodiment in a copy . . . is sufficiently permanent or stable to permit it to be perceived, reproduced, or otherwise communicated for a period of more than a transitory duration." (24:3.20). The term of protection for copyrighted works is the author's life plus 50 years (17:283). The copyright owner has the exclusive right to make copies of the work, control or prepare derivative works, to sue for damages and injunctive relief against anyone producing anything that is substantially similar, and to distribute copies of the work to the public by sale, rental, lease, lending, or other transfer of ownership (24:3.39; 17:286).

Copyright protection centers upon the original expression of an idea (17:286). Ideas and themes may have appeared in previous works, even much of the expression may have been produced before. In this case, if the author

created his/her work independently of previous works, he/she may obtain a copyright (17:287). An author can claim copyright in a work as long as he/she created it even if a thousand people created it before him/her (17:287). The Supreme Court has held that a work has originality if it is 'one man's work alone'. There must also be a 'modicum of creative work'. This requires that the author demonstrate the investment of some original work (17:291-293). Since the expression of an idea may be copyrighted, but not the idea itself, all are free to borrow the idea from a copyrighted work (17:297). Although computer programs clearly are copyrightable subject matter by virtue of amended section 117 of the Copyright Act, some programs may be ineligible for copyright protection because they either lack minimal originality, being so simple and basic as to reflect an inadequate investment of labor to merit copyright protection, or constitute the only way of accomplishing a particular result so that the program can be characterized as embodying an idea rather than as one way among many of expressing that idea (17:307).

A copy is any material object from which, either with the naked eye or other senses, or with the aid of a machine or other device, the work can be perceived, reproduced, or communicated (17:315). Infringement occurs whenever someone, without authorization, exercises the rights reserved exclusively for the copyright owner (17:323).

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Infringement requires access to a copyrighted work but need not be intentional. An independent creation without access is not an infringement (17:328-329). To prove infringement, a party must establish ownership of the copyright and impermissible copying (17:330).

Registration of a copyright with the Copyright Office is a formality and is mandatory only to initiate an infringement suit (17:282). Registration requires that at least a partial copy of the work be deposited with the Copyright Office. The deposited work is available to the public for inspection (17:282).

State attempts to control matters already regulated by the copyright laws are potentially preempted and invalid. State attempts to regulate matters that the copyright law could regulate but have been left free by federal legislation are also potentially preempted and invalid (24:403).

Potential conflicts exist between protection of a ROM mask by the Semiconductor Chip protection Act and the protection of object code in a ROM by the existing copyright law. Chapter 9 of 17 U.S.C., the Semiconductor Chip Protection Act, was enacted on 3 January 1985. (28: 98 Stat., 3347; 4:245). This act protects the mask works used to manufacture semiconductor chips. Under this act, the owner has the exclusive rights of reproduction, importation, and distribution (4:246). Reverse engineering

for purposes of producing an original mask is permitted
(28: 98 Stat., 3350). The term of protection under the
this act is 10 years. Chapters 1 through 8 of 17 U.S.C. do
not apply to this chapter and nothing in chapter 9 affects
any rights or remedies under chapters 1 through 8 (28: 98
Stat., 3354). Coverage of the Semiconductor Chip
Protection Act is beyond the scope of this study. The Act
is mentioned because it is a new and unique form of
protection and because the code in a ROM may be created
from the mask.

CASE REVIEW

The copyright case review evaluates several software related copyright cases from trial and appeals courts. These cases were selected because they best address the issues concerning the availability of copyright protection for software. The cases are reviewed in chronological order to illustrate the changes that have occurred in the court's view of software copyrights. The U.S. court system is heavily loaded and a substantial period may pass between the filing of a lawsuit and the trial. In the case of copyright infringement, the copyright owner may desire to have the defendant prohibited from continuing the allegedly infringing action (possibly the sale or distribution of a copy of the copyrighted work) until the trial occurs. A preliminary injunction provides this relief. The brief hearing required for a preliminary injunction will be scheduled earlier than a trial on the merits (the trial that will find facts, determine the applicable law, and apply the law to the facts to decide the outcome of the dispute between the parties). In a hearing on a motion for a preliminary injunction, the copyright owner must show a probable chance of success in a trial on the merits and must show that continuation of defendant's allegedly infringing actions will the cause plaintiff harm.

A hearing on a motion for summary judgement will also be expedited. A motion by either party for summary judgement is a request to the court that it find for movant (the party making the request) because there is no dispute of material fact and that movant is entitled to a decision as a matter of law. A trial on the merits is only needed if there is a dispute as to material facts (i.e., whether two software programs are substantially similar). The locations of the trial and appeals courts are given to allow the reader to recognize which cases were heard by the same courts.

Appeals courts and the Supreme Court have only the transcripts of the testimony from the trial court, the documents used by the trial court, and the appellate briefs prepared by the attorneys. The nature of the alleged error in the lower court will determine the extent to which the appellate court will review it. An alleged error of law will receive full review. A review of the finding of fact is usually limited to deciding if the judge or jury reasonably could have found as it did. There is limited scope of review of the trial judge's discretionary decisions. Only if an appellate court is convinced that the court below was clearly wrong will it reverse such a decision. (7:1005)

Goldstein v. California

93 S. Ct. 2303 (1973)

This Supreme Court case does not involve software,
however it gives a definition of an author: "An author is
an originator, he to whom anything owes its origin."

Synercom Technology, Inc. v. University Computing Co.

462 F. Supp. 1003 (N.D. Texas 1978)

This opinion discusses the application of copyright
law to a work that incorporated information in the public
domain. Synercom took computer instruction manuals that
were in the public domain, improved them, added to them,
and published them. Synercom is suing University Computing
for copyright infringement of these manuals. Defendant
claims that the manuals may not be copyrighted because they
are based on material that is in the public domain. The
court finds that the work to be copyrighted need not be
original, the author need only introduce any element of
novelty as contrasted to the material previously known to
him. If an assembly of known and novel material results in
an original expression then the whole expression is
protected. However, the non-original material is not
removed from the public domain. Therefore, if a computer
program incorporates software that is in the public domain,
with new software, the entire work may be copyrighted. The

work previously in the public domain remains in the public domain except when combined with the new software.

Data Cash Systems, Inc. v. JS&A Group, Inc.
480 F. Supp. 1063 (N.D. Ill. 1979)

Plaintiff claims that defendant has copied its copyrighted chess playing program. Defendant claims that the chess program, which is embedded in a ROM, is not a copy of the copyrighted program under the statutory definition of copy. In deciding this issue, the court investigates the nature of computer programs and ROMs.

The court claims that assembly language is a translation of the programming language into machine language, that assembly programs are "virtually unintelligible except by the computer itself", that an object program is a conversion of the machine language into a device commanding a series of electrical impulses, and that object programs enter into the mechanical process and cannot be read without the aid of special equipment and cannot be understood by even the most highly trained programmer. To substantiate these statements, the court references a book published four years prior to the trial (5). The introduction to this book states that it does not explain the details of creating a program (5:ix-x). The referenced pages do not state or imply the conclusions reached by the court. Assembly language is a mnemonic form

of machine language for the purpose of making machine language programming easier for humans. Object code is machine language which is used to command a series of electrical impulses. Object code is a series of binary digits that can be translated into assembly language by converting the numerical code into a mnemonic instruction. The court's statements indicate that it is confused by the different forms of code and it has failed to understand the basic concepts presented in the referenced book.

The court claims that a ROM is no more a copy of the program that it contains than a building is a copy of the plans. Reasoning that the ROM is a mechanical embodiment of a program, the court decides that it is not a copy of the program because mechanical devices are not writings and cannot be copyrighted. Holding: a ROM is not a copy of the program as the copyright law defines a copy and therefore copying of a ROM is not a copyright infringement. Apparently the court has decided that the medium of fixation, the ROM, and the program or expression of the copyrighted work embodied in it, are the same object.

Data Cash Systems, Inc. v. JS&A Group, Inc.

628 F.2d 1038 (7th Cir. 1980)

This is an appeal of the District Court's decision in 480
F. Supp. 1063 (1979).

Since the copyrightability of object code in a ROM was
not raised as an issue in the District Court or in the
briefs submitted with the appeal, that issue will not be
considered by the appeals court. The appeals court decides
the case solely on the legal requirement that copyrighted
works be properly marked. Nothing is explicitly said about
the copyrightability of object code in a ROM. Holding:
plaintiff forfeits its copyrights to the ROM because of its
unlimited distribution without the proper copyright
markings. This is an affirmance of the District Court's
decision but not its reasoning. Nothing is determined here
about the copyrightability of a program in a ROM. The
copyright law before the 1976 Act required that copyright
be forfeited if the copyright material was distributed
without the proper marking. The 1976 Act provides a means
for retaining copyright protection if the work is
distributed without the proper markings. Since the alleged
infringement here occurred prior to the enactment of the
1976 Act, the laws at the time of the pre-1976 Act laws are
used.

Stern Electronics, Inc.   Harold Kaufman et. al. and Omni
Video Games, Inc., et. al.

523 F. Supp. 635 (E.D.N.Y 1981)

Plaintiff Stern had registered the audiovisual
displays of an electronic game with the copyright office as
an audiovisual work. The audiovisual displays were
generated by software in a ROM. Stern did not to register
the software with the copyright office (as a literary
work). Stern seeks a preliminary injunction to stop
defendant from infringing its copyrights in the audiovisual
displays of the game.

For Stern to obtain the preliminary injunction, it
must show possible irreparable injury and either 1)
probable success on the merits or 2) sufficiently serious
questions going to the merits to make them a fair ground
for litigation and a balance of hardship tipping decidedly
toward them (Stern). Irreparable injury was shown by the
current popularity of Stern's game and its past sales
statistics. To show probable success on the merits, Stern
must show that it owned a copyright in the audiovisual
displays and that defendant copied the displays.
Compliance with statutory formalities, proof that the
displays are an original work of authorship, and proof that
the subject matter is fixed in any tangible medium of
expression, now known or later developed, from which they
can be perceived, reproduced, or otherwise communicated,

either directly or with the aid of a machine or device, must be shown to prove copyright ownership.

Defendants claim that the displays are not an original work of authorship because it is dependent upon the software and the ROM. They claim that the only original work of authorship is in the computer program (which has not been registered). The existence of a registered copyright raises a presumption of the validity of that copyright. Defendant Kaufman has the burden of producing evidence and persuading the court that Stern's copyright is invalid because the displays are not an original work of an author.

The court finds that the audiovisual displays are proper subject matter for copyright as an audiovisual work (provided that originality and fixation requirements are met). In holding that Stern will probably succeed on the merits, the court determines that the software and the displays "are quite separate in form and function" and that "identical audiovisual display[s] may be created from many different computer programs, and a slightly modified computer program may produce a wholly different audiovisual display." The court decides that the computer program and the ROM are merely the means that Stern has chosen to replicate its displays. The displays are original works of authorship. "An author's work does not become any less original after he has found a means to replicate it."

The court viewed a videotape of plaintiff's and
defendant's game displays. The court found the displays to
be substantially similar but not identical. This was
sufficient for the court to hold that Stern would probably
succeed in proving infringement at a trial on the merits.
Holding: Kaufman is enjoined from infringing Stern's
audiovisual copyright by selling their (Kaufman's) video
game.

Tandy Corp. v. Personal Micro Computers, Inc.
524 F. Supp. 171 (N.D. Cal. 1981)

Tandy Corp. claims infringement of its input/output
routines contained in ROM. Defendant claims that the ROM
is not a copy of the original program within the meaning of
the copyright laws. This court cites Data Cash Systems,
Inc. v. JS&A Group, Inc. 628 F. Supp. 1063 (N.D. Ill. 1979)
and states that it is not compelled to follow the reasoning
or decision of the Data Cash court. Holding: object code
in ROM can be copyrighted and therefore the ROM is a copy
of the original program within the meaning of the copyright
laws.

This court, as was the court in Data Cash, is a
District Court. Courts on the same level cannot set
precedents for each other (ref. Appendix G). This case
illustrates the uncertainty of legal action. Two courts
have examined substantially similar issues and have made

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contradictory decisions. The Tandy court's opinion
indicates that it did not attempt to evaluate the technical
differences between different forms of code at as detailed
a level as did the Data Cash court. The defendant here
apparently acted in response to the Data Cash decision
believing that object code in a ROM can be copied without
infringement. At this point, the copyright owner does not
know if an infringement suit for copying of object code in
a ROM will be upheld by the courts.

Stern Electronics, Inc. v. Harold Kaufman et. al. and Omni
Video Games, Inc., et. al.
669 F.2d 852 (2d Cir. 1982)

This is an appeal by defendant Kaufman from the
decision at 523 F. Supp. 635 (E.D.N.Y. 1981) that
preliminary enjoined defendant from infringing plaintiff
Stern's audiovisual copyrights in a video game. Defendant
repeats its claim that the audiovisual displays cannot be
copyrighted because they are not the original works of an
author. Defendant also contends that the displays cannot
be copyrighted because they are not fixed in a tangible
medium of expression. The fixation requirement is
allegedly not met because the sequence of displays
presented during a game differ depending upon player
input. Defendant concedes that the computer program in the

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ROM qualifies for copyright protection but the displays do not.

The court recognizes that many computer programs can be written to produce identical displays. If Stern had only registered the program for copyright protection, a different program could be developed that would duplicate the displays and Stern would have no infringement claim for either the program or the displays.

The court finds that the originality requirement is satisfied though the sequence of the creative process. "Someone first conceived what the audiovisual display[s] would look like and sound like. Originality occurred at that point. Then the program was written. Finally, the program was imprinted into the memory devices." It concludes that the "copyright is not defeated because an audiovisual work and the computer program are both embodied in the same components of the game."

The court references a computer technology textbook for the differences between RAM, ROM, and EPROM (14). It determines that "[t]he PROM stores the instructions and data from a computer program in such a way that when electric current passes through the circuitry, the interaction of the program stored in the PROM with the other components of the game produces the sights and sounds of the audiovisual display that the player sees and hears." The embodiment of the program in the PROM, and the

creation of the displays by the program, is sufficient to satisfy the fixation requirement.

Holding: the preliminary injunction is affirmed; there is originality in the creation of the displays, and the computer program and memory devices satisfy the fixation requirement.

Williams Electronics, Inc. v. Artic International, Inc.
685 F.2d 870 (3d Cir. 1982)

This is an appeal by defendant Artic of a final injunction permanently restraining and enjoining it from infringing plaintiff Williams's copyrights on the audiovisual displays and computer program in a video game. Defendant claims that the audiovisual copyrights are invalid because the displays do not meet the fixation requirements. The fixation requirement is not met because different displays are created each time the game is played. Defendant does not dispute that the code in its ROM is a copy of plaintiff's code, but rather claims that object code in a ROM cannot be copyrighted because a ROM is utilitarian and copyrights do not protect utilitarian objects.

The court references the Stern appeals court decision, 669 F.2d 852 (2d Cir. 1982), for the method of creating an audiovisual display by a program in ROM. Some of the Stern court's findings are held applicable to this case: an

electronic games's audiovisual display may be copyrighted, memory devices satisfy the fixation requirements for an audiovisual work, and player participation does not withdraw copyright protection from the audiovisual displays if there is a substantial amount of repetition of the displays on each play are applicable to this case. The embodiment of plaintiff's audiovisual displays in the memory devices satisfies the fixation requirement.

In determining that software in a ROM may be copyrighted, the court distinguishes between the medium of fixation (the ROM) and the code itself. A ROM itself may not be copyrighted but the code embodied in a ROM may be copyrighted. A copyright on a program in a ROM "no more restricts the use of ROMs than an author with a valid copyright restricts the use of books." The court "cannot accept defendant's suggestion [that code in a ROM may not be copyrighted because] that would afford an unlimited loophole by which infringement of a computer program is limited to copying of the computer program text but not to duplication of a computer program fixed on a silicon chip."

Holding: the trial court's decision is affirmed; defendant is permanently enjoined from infringing plaintiff's copyrights on audiovisual works and a computer program.

In this case a program that generates video game displays has admittedly been copied. In defense, the defendant claims that the output of the program cannot be copyrighted because it does not meet copyright requirements. When this argument fails, the defendant attacks the copyrightability of object code in ROM. In the Data Cash case, 480 F. Supp. 1063 (N.D. Ill. 1979), and in this case the defendant is opposing copyright protection for software in object form. Is the computer industry adding to the court's confusion? How is a court to resolve these issues when it has two computer industry parties presenting it with contradictory information?

Apple Computer, Inc. v. Franklin Computer Corp.
545 F. Supp. 312 (E.D. Penn. 1982)

This is a hearing on a request by Apple for a preliminary injunction to stop Franklin from marketing 14 computer programs Apple claims have been illegally copied. The court gives functional descriptions for CPU, RAM, ROM, EPROM, PROM, and each of the fourteen programs in question. The court distinguishes between applications and operating systems programs by stating that applications programs have a specific task, while operating systems programs are internal to the computer, and that an operating system is the means by which a computer is

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transformed and reduced to a different state or thing. The
programs in question here are operating systems programs.

The court cites conflicting cases concerning the
copyrightability of object code in ROM. Considering the
object code in a ROM and the ROM itself to be the same
entity, the court notes that the CONTU final report made no
recommendations for chips but stated that object code can
be copyrighted. Showing its confusion as to what is the
work that is to be copyrighted, the court asks if it is the
source code or the ROM. Referring to the District Court's
opinion in Data Cash, the court uses the analogy of the
relationship between plans and a building constructed from
those plans, and the relationship between a program and a
ROM constructed from that program.

The court has spent significant time (as indicated by
the functional descriptions in the opinion) investigating
the technical issues and it still fails to distinguish
between the object code and the device (the ROM) containing
the object code. This is particularly evident from the
court's reference to the CONTU report which supports
copyrights for object code. The court asks the right
question, where is the work to be copyrighted, but fails to
consider that it could be in the object code. Convinced
that a real controversy exists concerning the
copyrightability of object code in a ROM, the court denies
Apple's request for preliminary injunction claiming that

Apple has not shown a probability of success in a trial on the merits.

Midway Manufacturing Co. v. Roger Strohon et. al.
564 F. Supp. 741 (N.D. Ill. 1982)

This case involves the marketing of ROMs by the defendant for the purpose of modifying video games to provide new challenges to the game's players. The video games were originally marketed by plaintiff. Plaintiff claims that defendant copied its computer programs contained in ROM and markets these programs with the 'modification kit' ROMs. The court cites two legal issues from the Copyright Act: 1) the owner of a copyright has exclusive right to prepare derivative works from the the copyrighted work and 2) software owners are allowed to adopt their programs for use in conjunction with a machine. Is defendant's modification kit a derivative work of plaintiff's computer program or is defendant an owner of plaintiff's computer program and is he modifying that program for use in conjunction with a machine?

The court finds that human readable source code is clearly copyrightable. The next issue is whether object code is copyrightable. In deciding that object code can be copyrighted, the court argues: 1) Congress enacted the CONTU final report recommendations almost verbatim and therefore must have intended what CONTU intended, 2) the

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definition of a computer program in section 101 includes
object code because object code is used directly in the
computer to achieve a certain result, 3) object code can be
read by humans, and 4) object code is a direct translation
of source code. What allowed this court to determine that
object code directly instructs the computer, that object
code can be read by humans, and that object code is a
direct translation of source code, while other courts
failed to understand these issues? A reference to a
journal article appears to be the only outside source of
technical information for the court (23). This 60 page
article is worth reading for its detailed coverage of the
state of computer law at that time. Early in the article,
Schmidt, a law student, states "An inquiring legal mind
cannot reject the thought that the testimony of experts is
sometimes not enough, that a personal acquaintance with the
principles upon which a physical thing is constructed may
produce important legal insights upon which the outcome of
a client's case or the ends of justice may turn." (23:349-
350). The court's statement that only highly trained
computer specialists can read object code can be inferred
from Schmidt (23:352). The court's discussion on the
classification of a ROM chip as firmware also appears to
have been taken from Schmidt (23:359-361).

A footnote to the opinion states that a discussion of base 16 counting consumed an inordinate amount of the hearing. Apparently there was much discussion of technical issues during the trial and the learning process was slow. The issues discussed in the opinion and the decisions reached do not indicate a need for the knowledge of base 16 counting.

The holding supports copyrightability of object code in ROM. It seems that this was decided when the court realized that object code is included in the definition of a computer program given in section 101 of the Copyright Act. The consideration of the readability of object code by humans, the fact that object code is a direct translation of source code, and the difference between firmware and software seem unnecessary for the decision reached here.

Apple Computer, Inc. v. Franklin Computer Corp.
714 F.2d 1240 (3d Cir. 1983)
This opinion is reprinted in Appendix A.

This is an appeal from 545 F. Supp. 812 that denied Apple's request for a preliminary injunction to stop Franklin from marketing 14 software products that Apple claims were copies of copyrighted Apple programs. This is considered a landmark case that determines the copyrightability of computer programs in source code and

object code, determines if operating system programs and application programs are treated differently under copyright law, and determines if object code in a ROM can be copyrighted. The opinion contains a description of the trial court's reasoning, a brief history of the current copyright law, the important points to be considered in software copyrights, excerpts from the copyright statute, comparisons between software patents and copyrights, and firm reasoning for the decisions of this court.

Citing "useful non-technical descriptions of computer operations" the court briefly defines the differences between source code, assembly code, and machine code. Apparently the court is satisfied with a limited, high level knowledge of computer technology.

As in previous software copyright cases, defendant admits copying the programs in question. Franklin's primary defense is its claim that the Apple operating system programs cannot be copyrighted. The lower court denied Apple's request for injunction on 30 July, 1982. This appeals court handed down its decision in Williams Electronics, Inc. v. Artic International, Inc., 685 F.2d 870 (3d Cir. 1982), on 2 August, 1982. Apple appeals the lower court decision on the basis of the Williams decision.

The legal issues to be decided here are: 1) whether copyright can exist for a computer program expressed in object code, 2) whether copyright can exist for a computer

program embedded on a ROM, 3) whether copyright can exist for an operating system program, and 4) whether independent irreparable harm must be shown for a preliminary injunction in copyright infringement actions.

The court reasons that computer programs meet the copyright requirements of being an original work fixed in a tangible medium of expression and that the 1980 Copyright Act amendments, which include a definition of computer program and a revised section 117, clearly provide copyright protection for programs. The argument that object code cannot be copyrighted because it cannot be read by a human reader is invalid because section 102 of the statute extends protection to works in any tangible means of expression "from which they can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device."

The court reasoned that object code can be copyrighted because section 101 of the statute defines computer programs as "sets of statements or instructions to be used directly or indirectly in a computer in order to bring about a certain result." Since source code instructions must be translated to object code before the computer can act upon them, only instructions expressed in object code can be used "directly" by the computer.

The court rejected the argument that object code in a
ROM cannot be copyrighted since the ROM is a utilitarian
object and utilitarian objects are prohibited by statute
from being copyrighted. The court determined that the ROM
and the object code embedded in it are different entities.
The ROM is the medium in which the object code is fixed.

Franklin argues that an operating system program is
either a process, system, or method of operation; all of
which are prohibited from copyright protection by section
102. The court reasons that Apple's copyright on the
operating system program protects the expression, the
sequence of instructions. The copyright does not protect
the method which instructs the computer to perform its
operating functions. Franklin's argument that operating
system programs are processes or methods is inconsistent
with its claim that applications programs may be
copyrighted. Since both types of programs instruct the
computer, both are included in the section 101 definition
of a computer program and both may be copyrighted. Nothing
in this definition distinguishes between types of computer
programs. The court rejects Franklin's argument that
operating systems programs are part of the machine, finding
that this argument "mistakenly focuses on the physical
characteristics of the instructions." Franklin made this
claim because the operating system programs were embedded
in ROM. The court rejected the claim that programs

embedded in ROM could not be copyrighted. The District
Court's decision appears to be based on an erroneous view
that operating system software cannot be copyrighted and on
unnecessary concerns about object code and ROMs.

In discussing the necessity of showing irreparable
harm for a preliminary injunction, the court cited the
CONTU report which recognized the large investment required
for software development and the underlying public interest
basis for the copyright laws. If a party can show adequate
evidence of the expenditure of significant time, effort,
and money in producing copyrighted material, then the
public interest underlying copyright law requires a
presumption of irreparable harm.

Holding: 1) computer programs in source code and
object code may be copyrighted and thus are protected from
unauthorized copying, 2) a computer program in object code
form embedded in a ROM chip may be copyrighted, and 3)
operating systems are not precluded from copyright
protection.

Apple Computer, Inc. v. Formula International, Inc.
725 F.2d 521 (9th Cir. 1984)

This is an appeal from 562 F. Supp. 775 that held that
Formula had copied Apple's copyrighted operating system
programs. Formula claims that operating system programs
are ideas or processes and unlike application programs,

cannot be copyrighted. Formula relies on the dissenting opinions to the CONTU final report by commissioners Nimmer and Hersey. Hersey did not want copyright protection for object code and Nimmer did not want copyright protection for any program unless the program produces a work that by itself qualifies for copyright protection.

The court references the section 101 definition of computer program and states that the definition does not distinguish between different types of programs. The court accepted Apple's testimony that other methods exist for writing the programs in question and therefore the expression copyrighted by these programs did not preempt use of the underlying idea. The court accepted expert testimony and did not delve into the technical details. This court affirmed the lower court's decision.

ANALYSIS AND EVALUATION

Computer software in source code form receives copyright protection when it is fixed in a tangible medium of expression (provided that the work is original and there is a modicum of creativity). Copyrights for object code have been contested on the basis that when the object code in fixed in a ROM it is not copyrightable. The Apple v. Franklin appellate decision is considered to have firmly decided that object code, whether in a ROM or not, is copyrightable. This case also established that all forms of software receive the same treatment and that the copyright statute does not distinguish between types of software (applications or operating system code). Registration of the work with the Copyright Office is mandatory only to initiate an infringement suit. Registration can be accomplished after the infringing act occurred and prior to initiation of the lawsuit.

A copyright on software protects the sequence of statements (the author's expression) but not the algorithm (the idea from which the expression is derived) (13:58). The software is protected from exact copying and from creation of substantially similar works based on the copyrighted work. Only the copyright owner can prepare derivative works. However, the software purchaser/lessor may adapt the software for use on a particular machine (17

U.S.C. section 117). Exact or substantially similar duplication by independent creation without access to the original work is not infringement.

In an infringement action, the copyright owner bears the burden of proving that the defendant had access to the copyrighted work and that the defendant's work is a copy of, or is substantially similar to the copyrighted work. The court has determined 'substantial similarity' by examining the program's output but has not examined the expression (the code) itself. The court may have difficulty determining substantial similarity in a system where the infringer expends significant effort concealing the copy. When large program systems are involved it would not be feasible to compare the source code to determine if the programs were substantially similar.

The various courts handled the technical issues differently. Some courts investigated the technical issues to a level where they relied on outside references and spent an 'inordinate amount of time' on one issue, while others ignored the technical issues and only looked at legal issues. In copyright infringement cases the majority of the court's work will be in determining if infringement has occurred. The similarity of video game programs has been determined by comparing the program's output. This is appropriate when infringement of the displays (as audiovisual works) is the issue. However, when

infringement of the program is the issue, the accuracy of
this method is questionable. For programs, the court will
have to examine the sequence of statements and overall
modular structure. This comparison will be difficult for a
non-technically trained court. Expert witnesses could be
used, but it is likely that each side could find an expert
to testify in their favor. The court would either have to
base its decision on the credibility of the witnesses or
evaluate the software itself.

In summary, the cases have shown that even with the
support of precedents, the legal process is uncertain and
the law is constantly changing. Some courts will examine
technical details while others will not. Much trial time
may be spent educating the court. The attorneys will be
the educators and it is likely that the education they
provide will be biased in their party's favor and may
confuse rather that enlighten the court.

The copyright statutes provide explicit references to
computer programs and it appears that the legislature
intended copyrights to be the preferred method of
protecting computer software. As will be seen in later
chapters, patent and trade secret protection is also
available but is more restrictive in what types of software
qualifies for protection. Patent and trade secret
protection requires more effort and expense to obtain than
copyright protection.

III. PATENT PROTECTION

INTRODUCTION

This chapter examines the protection available to computer software under the patent laws. The chapter begins with a discussion of patent law. Recent software related patent cases are reviewed, and then the statutes and cases are analyzed to determine the usefulness of patent protection to the software developer/distributor.

BACKGROUND

The authority for Congress to enact patent laws comes from the same source as copyright law, the Constitution, Article 1, section 8, (17:7). The first patent statute was enacted in 1790. It was revised in 1793, 1836, and 1952. The current statute is 35 U.S.C. (17:8).

The Patent and Trademark Office (PTO) was formed in 1836. It was given the authority to examine patent applications and to determine if an application satisfies the requirements of the statute (17:9). The PTO issued a statement in 1964 stating that it did not believe that computer programs could be patented because they were creations in the area of thought (10:102). In 1965 the President's Commission on the Patent System recommended that programs not be granted patents. Legislation

introduced in both houses of Congress to implement this recommendation did not pass (10:102). In 1968 the PTO declared that computer programs are not patentable. The Court of Customs and Patent Appeals (CCPA), the appellate review court for the PTO's decisions, disagreed because it found no basis for this conclusion in statute (10:102).

To qualify for a patent, the claimed invention must be within one of four specific categories of patentable subject matter: a new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof. The claimed invention must also meet four separate conditions for patentability: utility, novelty, nonobviousness, and adequate disclosure (24:4.6). Nonpatentable subject matter includes ideas, natural laws, forces, principles, mental steps, mere printed matter, methods of calculation, and mathematical equations.

The patent application contains a specification and claims. The specification describes how the invention works. The claims are the asserted new, useful, nonobvious advances beyond the prior state of the art of which the invention is a part. The claims point out what features of the specification are patentable (17:10). The purpose of the patent system is to encourage the development of technology by making patent applications public documents.

The specification must describe how the invention works and how to reproduce it (17:10).

Claims for program patents must be either as machines (apparatus) or processes (10:101). Machine patents cover devices that must be used in connection with an actual mechanism (10:101). In a machine claim, the program controls the computer, and together the program and the computer create a special and unique mechanism. A process is a mode of treatment of certain materials to produce a given result. It is an act, or a series of acts, performed upon the subject matter to be transformed and reduced to a different state or thing (10:101). In a process claim, the program must control a process which is new and useful (25:28).

Utility, the quality of being useful, has not been an issue in program patent applications (24:4.18).

The test for novelty is whether there is a single item of prior art that contains all of the essential elements of the claimed invention (24:4.19). What the prior art is and what the claimed invention is, are questions of fact as opposed to questions of law (10:100).

The requirement that the invention be nonobvious prevents a patent from being granted if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious, at the time the invention was made, to a

person having ordinary skill in the art to which the
subject matter pertains (24:4.20). To determine whether an
invention is nonobvious, the scope and content of the prior
art are to be determined; differences between the prior art
and the claims at issue are to be ascertained; and the
level of ordinary skill in the pertinent art resolved
(24:4.20). The test of nonobviousness is to be applied as
of the time of the invention and not as of the time of the
suit (10:100). The nonobviousness analysis is complicated
in program-related inventions because the PTO lacks
extensive prior art files, an adequate system of
classification, a searching technique, and research files
for computer programs (24:4.20).

Adequate disclosure requires that the inventor
disclose the invention to the public in such full, clear,
concise, and exact terms as to enable any person skilled in
the art to make and use the invention. The disclosure must
be sufficient to enable others to construct and use the
invention after the expiration of the patent and to inform
the public, during the life of the patent, of the limits of
the monopoly asserted so that the public may know which
features may be safely used or manufactured without a
license and which may not (24:4.21).

If an invention contains an algorithm, the point of
novelty, and preemption tests must be applied. The point
of novelty test states that if the novel element in an

invention is in the algorithm, the invention is not patentable. The preemption test states that if the patent would wholly preempt other uses of the algorithm, the invention is not patentable (24:4.12-4.14).

Unlike copyrights, no rights immediately accrue upon submission of a patent application. There is no monopoly right in an invention until the patent is issued by the PTO (17:10).

The patent owner has the exclusive right to make, use, or sell the invention to the absolute exclusion of others for the period of the patent (17 years). Patents, like copyrights, cannot be renewed. When a patent expires the invention enters the public domain and anyone may make, use, or sell the invention (17:11-12).

A patent owner may sue anyone believed to be or have been using part or all of the basis of the patent without authorization (17:13). For patent infringement to be found, the allegedly infringing invention must have substantial identity of function, means, and results (10:108). An infringing machine must perform substantially the same function by substantially the same means, and the principle or mode of operation must be the same as that of the machine infringed upon (10:108). A valid defense for a charge of infringement is to show that the grant of the patent was unwarranted. The defendant must prove that the PTO was mistaken in granting the patent by showing that the

patent does not possess the required amount of novelty,
utility, or nonobviousness (17:13). Alleged patent
infringers have been quite successful in attacking the
validity of patents. Between 1881 and 1945 the Supreme
Court heard 403 patent cases and held 80% of the patents
invalid. The CCPA invalidated 40% of the patents it
considered (10:106-107).

When an infringement suit is brought against a
software related patent, the defendant could claim a lack
of novelty in the patented program by showing that similar
programs exist. A court may have difficulty making an
intelligent finding of fact concerning the differences
between the programs (10:107). The defendant in a software
related infringement suit could also claim that the program
is obvious. The defendant could easily build a strong case
that a programmer of ordinary skill, particularly one
working the same specialty as the plaintiff, could easily
have written the plaintiff's program at the time the
plaintiff did. Once again the technology could confuse the
court and help the defendant's case (10:107).

To apply for a patent, an application is submitted to
the PTO. In processing the application, the PTO searches
past patents and relevant technical literature to ascertain
whether the claims are actually new, useful, and
nonobvious. The patent examiner frequently denies
patentability to some or all of the claims. The

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application may be revised to meet the examiner's objections or it may be resubmitted with an explanation why the examiner is mistaken, arguing that the application is suitable in its original state (17:10-11). If, during the examination process, it becomes apparent that one or more other patent applications either currently being considered, or granted within the preceding year, make similar or identical claims, the Patent Office Board of Interference Proceedings must determine which application first conceived and reduced the invention to practice (17:11). If the PTO denies a patent, the inventor can appeal to the Patent and Trademark Board of Appeals (PTBA). The decision of the PTBA can be appealed to the Court of Appeals for the Federal Circuit (CAFC), formerly the Court of Customs and Patent Appeals (CCPA). The CAFC's decision may be appealed to the Supreme Court.

Any person may ask the PTO to re-examine a patent. If the PTO grants a re-examination, the patent application will undergo a second, more limited examination (17:13-14). A party who wishes to use a patent they believe is invalid may ask a federal court for a declaratory judgement that the patent is invalid. The party must demonstrate that a real controversy about patent exists before the court will allow the suit. Then the party must show that the PTO was mistaken in granting the patent by showing that

the patent does not possess the required amount of novelty, utility, or nonobviousness (17:14).

Historically, the various patent review tribunals have taken a firm stand on one side of the software patentability controversy. The PTO and PTBA have consistently turned down every application for a patent on a computer program. The CAFC/CCPA has consistently fought for software patents, even with opposition from the Supreme Court (25:27).

Registration of patents is mandatory for protection, whereas copyright protection is available without registration. Patent registration involves a review of the invention and an evaluation of the invention's qualifications for protection. Copyright registration is merely a formality, no review of the work is accomplished. In both cases, one purpose of registration is to make the work available to the public. Patent registration usually requires the assistance of a patent attorney to complete the required documents. Copyright registration only requires completion of simple forms and can be accomplished without legal assistance.

There are several differences between patents and copyrights. A patent grants a virtual monopoly to produce the invention. Independent discovery/invention is prohibited. Copyrights do not protect against independent discovery. The appeals route for patents always uses the

same courts, copyright appeals go to many different
courts. The term of protection is 17 years for patents,
the term of protection for a copyright is the life of the
author plus 50 years. Patents protect objects that have
utility, copyrights protect works of an author.

CASE REVIEW

This section reviews important software related patent cases. All of the cases are appeals hearings by the Court of Appeals for the Federal Circuit (CAFC), its predecessor, the Court of Customs and Patent Appeals (CCPA), or the Supreme Court. Patent applications are submitted to the PTO. If the application is rejected, the applicant may appeal to the Patent and Trademark Board of Appeals (PTBA). If the PTBA also rejects the application, the appeal may be brought before the CAFC. Either the Patent Examiner, on behalf of the PTO, or the applicant may request certiorari (a review of the CAFC/CCPA decision) by the Supreme Court.

Gottschalk v. Benson
93 S. Ct. 253 (1972)

A patent is sought for a method of programming a general purpose digital computer to convert signals from binary coded decimal form into pure binary form. The court must determine if the invention is a process as defined in section 101 of the patent statute. The method operates on existing machines, nothing new about the machines involved is specified.

Scientific truths, mathematical formulas, principles in the abstract, fundamental truths, original causes, and motives cannot be patented. An invention derived from a

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scientific truth or law of nature must come from the application of the truth/law to a new and useful end. The process claim here is so abstract that it covers both known and unknown uses of binary coded decimal to binary conversion. The patent monopoly must be confined to rather definite bounds. A process may be patented irrespective of the machinery used to carry out the process. However, transformation and reduction of an article to a different state or thing is required to patent a process claim that does not include particular machines. Process patents are not limited to chemical action, physical action is allowed.

The court states that it is possible for a process patent to be issued even if prior precedent requirements are not met. Previously, a process patent could only be issued if the process were tied to a particular apparatus or if the process operated to change material to a different state or thing. "The mathematical formula here has no substantial practical application except in connection with a digital computer, which means that if the judgement below is affirmed, the patent would wholly preempt the mathematical formula and in practical effect would be a patent on the algorithm itself." Holding: the invention here is not patentable subject matter as defined in section 101. The decision of the CCPA is reversed and the patent is denied.

The court points out that its decision here applies only to digital computers and not to analog computers. The court found it necessary to refer to a computer technology book to determine the difference between an analog and a digital computer (2:4). The preface of this book states that it was written "for the person who wants to develop an understanding of digital computers and their operation without trudging through an excess of design and construction detail." (2:v). " It is a book for the person who wants more than a "cocktail party conversation" familiarity with digital computers, but who does not have the background or the desire to delve into a rigorous consideration of electronic digital computer design techniques." (2:v).

The opinion closes with a request for Congressional policy guidance on the patentability of computer software: "It may be that patent laws should be extended to cover these programs, a policy matter to which we are not competent to speak. The technological problems tendered in the many briefs before us [14 groups filed amicus curiae briefs on the merits of this case] indicate to us that considered action by the Congress is needed."

Dann v. Johnston

96 S. Ct. 1393 (1976)

The invention here is a machine system for automatic record keeping of bank checks and deposits. The bank furnished customer statement would have subtotals of various categories of transactions completed in connection with the customer's single account, thus saving the customer the time and/or expense of doing this himself. The customer writes a category code (a number) on each check and deposit slip. This number is used to sort the transactions into categories for calculating subtotals. The customer category code is put on the check or deposit slip in magnetic characters (by the bank) as is currently done for the amount of the transaction.

The PTO rejected the application because the claims were anticipated by the prior art (section 102 requirements) and because the claims did not point out and distinctly claim what the claimed invention is (section 112 requirements). The PTBA rejected the application because it was indefinite and did not distinctly enough claim what the invention is, and because the claims were not statutory subject matter as defined in section 101. The CCPA reversed the PTBA finding the invention to be valid subject matter (under section 101), finding the claims to be narrowly enough drawn for section 112, and finding that neither established banking practice nor prior patents

rendered respondent's system obvious to one of ordinary skill in the art.

The Supreme Court stated that the general patentability of computer programs would not be addressed in this case. The issues here are relating to obviousness: the scope and content of the prior art, the differences between the prior art and the claims at issue, and the level of ordinary skill in the pertinent art.

The court reasons that "The mere existence of differences between the prior art and an invention does not establish the invention's nonobviousness. The gap between the prior art and respondent's system is simply not so great as to render the system nonobvious to one reasonably skilled in the art." The court determines that Johnston's invention would be obvious to one skilled in the art because the banking industry currently uses automatic data processing equipment in preparing the statements for individual accounts and because a patent has been issued for an automated data processing system using a programmed digital computer to maintain transaction and balance files for each department of a business organization. These systems are not the same as Johnston's but are assumed to be known to a person skilled in the art, and as such Johnston's system would have been obvious to a person skilled in the art. Holding: the invention is unpatentable because it is obvious (section 103).

Parker v. Flook

98 S. Ct. 2522 (1978)

This opinion is reprinted in Appendix B.

This opinion is written by Justice Stevens. A
dissenting opinion written by Justice Stewart, joined by
Justice Rehnquist and the Chief Justice is also included.
In Diamond v. Diehr, the opinion is written by Justice
Rehnquist. A dissenting opinion is written by Justice
Stevens, joined by Justices Brennen, Marshall, and
Blackmun. This is emphasized because of the strong
differences of opinion between the majority and dissenting
opinions in both cases, and because of the differing
results on similar inventions in both cases.

The application is for a method (process) for
updating alarm limits. The invention uses an equation to
calculate the alarm setting for process variables involved
in the catalytic conversion of hydrocarbons. The alarm
limit of one of several process variables (i.e.,
temperature, pressure, etc.) depends on the base (normal)
value of the variable, a weighting factor, and a margin of
safety. The attainment of the alarm limit value by the
process variable could signify a dangerous condition. The
process variable varies during the conversion process and
the alarm limit must be recalculated at an operator
specified time interval. The alarm limit varies as the

measured value of the process variable varies and also depends on the previous alarm limit value.

The court finds that the only novel feature of the method is the mathematical formula used to calculate the new alarm limit. A result of the Benson decision is that the discovery of a novel and useful mathematical formula may not be patented. The issue here is whether the identification of a limited category of useful, though conventional, post-solution application of such a formula makes the respondent's method eligible for patent protection. The court emphasizes that the patent application does not tell how to select four values needed in the formula, how to monitor the process variables, how the chemical process works, or how to set off an alarm or an adjusted alarm system.

The patent claims cover any use of the formula for updating the value of an alarm limit on any process variable involved in a process comprising the catalytic chemical conversion of hydrocarbons. The claims do not preempt the algorithm (in contrast to Benson). If the claims did preempt the algorithm, a patent would, in effect, grant a monopoly on the idea. Ideas are nonpatentable subject matter. The PTO and PTBA found the point of novelty in the invention to be in the mathematical formula. Citing Benson, the PTBA decides that a patent

here is prohibited because it would be in effect a patent on the formula.

The Supreme Court states that the issue here is whether this invention is patentable subject matter under section 101. The issues of novelty and nonobviousness (sections 102 and 103) are not involved. For purposes of analysis, the formula (not the invention) is assumed novel and useful. The formula is assumed to be the only novel part of the invention (since the respondent does not contest this). The question to be answered is whether the discovery of the formula makes an otherwise conventional method eligible for patent protection. Prior precedent in process claims required that the process be tied to a particular apparatus or that the process be operated to change materials to a different state or thing. The court here, as in Benson, explicitly states that a valid process patent may be issued even if it does not meet one of these qualifications. The court states that here, as in Benson, the method is a process in the ordinary sense of the word. However, a purely literal reading of section 101 is not permitted. An algorithm or mathematical formula is like a law of nature which established precedent says cannot be patented.

The court finds that the proper analysis for this case requires that the process itself, not merely the mathematical algorithm, be new and useful. The novelty of

the mathematical algorithm is not a determining factor at all. Whether the algorithm was in fact known or unknown at the time of the claimed invention, as one of the basic tools of scientific and technological work, it is treated as though it were a familiar part of the prior art. Flook claims that this improperly imports into section 101, the considerations of inventiveness which are the proper concerns of sections 102 and 103. The court says that Flook is incorrect because a process application does not automatically fall within section 101 if it implements a principle in some specific fashion.

The court does not dispute that respondent's method, as well as natural phenomena, are processes, but rather holds that they are not the kind of discoveries that the statute was enacted to protect. The court is considering the intent of the legislature that enacted the statute rather than the literal wording of the statute. The determination of what type of discovery is sought to be patented must precede the determination of whether that discovery is new or obvious. Respondent cites a CCPA decision that a claim cannot be dissected, the claim components searched in the prior art, and if the only component found novel is outside the statutory classes of invention, the claim be rejected under section 101. This court says it is consistent with this point. It adds that a claim must be considered as a whole. The court then

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states that respondent's claim is unpatentable because once the algorithm is considered prior art, the application considered as a whole contains no patentable invention. The court's reasoning here is not clear. It seems that the court has done what it said could not be done, it dissected out the novel part, defined it as prior art, replaced it in the whole process as not novel, and then found the entire process to be without novelty.

Flook's invention fails the novelty requirement because the process containing the software is not novel. the court will not allow the point of novelty to be in the software, the process as a whole must be novel. "Even though a phenomenon of nature or mathematical formula may be well known, an inventive application of the principle may be patented. Conversely, the discovery of such a phenomenon cannot support a patent unless there is some other inventive concept in its application." The court claims that the following are well known: the chemical processes in the catalytic conversion of hydrocarbons, the monitoring of process variables, the use of alarm limits to trigger alarms, the notion that alarm limit values must be recomputed and readjusted, and the use of computers for automatic alarm monitoring. Therefore, respondent's application is simply a new and presumably better method for calculating alarm limit values. Holding: "A claim for improved method of calculating, even when tied to a

specific end use, is unpatentable subject matter under section 101." The court adds that it must follow its precedents even though they were set before the start of the computer industry. The court acknowledges that patent protection of certain novel and useful computer programs might promote the progress of science and the useful arts, however, these are policy issues which must be answered by Congress.

Dissenting Opinion - Parker v. Flook

The dissenters agree that Benson stood for a common ruling that laws of nature, physical phenomena, and abstract ideas are not patentable subject matter. The Benson algorithm was held unpatentable because it was not limited to any particular art or technology, to any particular apparatus or machinery, or any particular end use. A patent would preempt the mathematical formula and would be a patent on the algorithm. The issue here is different, the issue is whether a claimed process looses its status of subject matter patentability simply because one step in the process would not be patentable subject matter if considered in isolation. The dissenters cite a case that used the law of gravity and was found patentable. As the CCPA said, Benson does not apply here because the claim does not preempt the algorithm.

The dissenters claim that the majority decision incorrectly imports into its inquiry under section 101 the criteria of novelty and usefulness. They believe that the process meets the section 101 requirements. They do not decide on the the issues of novelty and obviousness of sections 102 and 103.

The author's evaluation - Parker v. Flook

This disagreement is based on a reading and interpretation of the law. The wording of section 101 includes 'new and useful', and seems to allow the majority's consideration of what is intended to be patentable subject matter. However, section 102 also covers novelty and seems to be more specific in that matter than section 101. The issue could be rephrased to ask if the process here is an idea, law of nature, or mathematical formula. The claim is for a process of updating alarm limits. Since alarm limits do not occur in nature, the claim is probably not a law of nature. An alarm limit in the abstract is a number. However, when it is applied to an alarm device it becomes an electro-mechanical state or setting, not an idea or a mathematical formula. The majority uses a determination of prior art for all parts of the claimed process to reduce the claim to the single novelty of the formula. The majority states that "Respondent's application simply provides a new and

presumably better method for calculating alarm limit values." Then the court claims that an improved method of calculation cannot be patented. The implicit use of novelty also occurs in the majority argument when it assumes the algorithm to be prior art and concludes that the whole process is unpatentable because there is no 'inventive concept'. Isn't this another way of saying 'new concept'?

In re Matter of Application of Bradley

600 F.2d 807 (C.C.P.A. 1979)

This opinion is reprinted in Appendix C.

The claim is for an apparatus, a Switch System Base Mechanism. The function of the invention is not clear from the description in the opinion. The opinion refers to the patent application when describing the invention but the application is not included in the opinion. The court's description of the invention follows. In a multiprogramming computer, the system base is a fixed area in main memory which acts as the root for information structures in the computer. For efficiency, portions of the system base are stored in scratchpad registers. "These registers are invisible to the programmer since, unlike main memory, they cannot be accessed by software." In prior art systems, the user could change data in the scratchpad registers by causing all scratchpad registers to

be reloaded or by using software which takes advantage of the model dependent properties of the computer. The former method is claimed to be too slow, the latter method's reliance on model dependent software is claimed to be undesirable.

Apparently the system base is an operating system control block(s) used to maintain data about processes. The model dependency required to access the registers with software is probably assembler language. The opinion first says that the data in the registers cannot be accessed with software, then it says that model dependent software can access the registers.

The invention here claims to overcome the disadvantages of the prior art techniques by using microcode to transfer data between the scratchpad registers and the system base. The need for software portability is a primary reason for avoiding model dependent software. However, this method merely moves the machine dependency from the software to the microcode. All systems that would run the software would need the microcode.

The PTO, which ruled before the Flook decision, held the invention to reside in a data structure or algorithm which is nonstatutory subject matter under Benson. Bradley argued before the PTBA that the data structure is a specific, new, useful, unobvious arrangement of hardware. The PTBA, ruling after the Flook decision, rejected the

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application (on the basis of Flook) because the claims are directed to a method of calculation or mathematical algorithm. They reasoned: "Since digital computers normally operate in some numerical radix, binary, binary coded decimal, or the like, we consider the operation of appellant's claimed invention to be mathematical."

The CCPA here holds that the PTO erroneously interpreted Benson to mean that all computer programs or program related inventions are nonstatutory under section 101. The PTBA incorrectly reasoned that since computers operate in some number radix then the patent application is for a mathematical formula. The PTBA's analysis confuses what a computer does with how it is done. "Thus the Board's analysis does nothing but provide a quick and automatic negative answer to the section 101 question simply because a computer program is involved."

In reviewing the application, the CCPA finds that the application claims a combination of hardware elements which enables the computer to alter the information in its system base in a manner not previously possible. The information acted on by the invention is irrelevant to the operation of the invention itself. The claim falls within section 101. The issues of novelty and obviousness are not before the court. The invention is a combination of hardware elements, including microcode. The outcome would be different if only the microcode was claimed.

The CCPA finds no mathematical formula or claim of mathematical calculation that is essential to the validity of the claim (in contrast to Benson). Holding: the invention is statutory subject matter

Diamond v. Diehr

101 S. Ct. 1048 (1981)

This opinion is reprinted in Appendix D.

This opinion was written by Justice Rehnquist, the author of the dissenting opinion in Flook. The dissenting opinion here was written by Justice Stevens (joined by Justices Brennan, Marshall, and Blackmun), the author of the majority opinion in Flook.

The invention here is a process for curing synthetic rubber. Curing rubber involves using the proper temperature for the proper time duration. Diehr claims that this method ensures proper curing. Arrhenius' equation (used in this invention) uses time and temperature cure relationships to calculate the time to open the mold. However, Arrhenius' equation depends upon a constant temperature in the mold for the duration of the curing. The mold temperature decreases while the mold is open to remove the cured product and to load the raw material. The time necessary to reheat the mold to the proper temperature is variable. This invention continuously measures the mold temperature with a thermocouple. The temperature is fed

into a computer which repeatedly recalculates the cure time. When the cure time equals the elapsed time, the computer signals a device to open the mold.

Diehr claims that the following are new in the art: continuous measurement of the temperature inside the mold, the feeding of the temperature to a computer which constantly recalculates the cure time, and the computer signal used to open the press. The issue to be resolved here is whether the invention is patentable subject matter under section 101.

The PTO rejected the application holding that the steps carried out by the computer were nonstatutory under section 101 and that all other steps, the loading of the press and the closing of the press, were conventional and necessary and could not be the basis of patentability. The PTBA agreed. The CCPA reversed the PTO's decision, finding no mathematical algorithm or improved method of calculation. A claim drawn to subject matter otherwise statutory does not become nonstatutory because a computer is involved.

The Supreme Court begins its analysis with the statute, stating that the words of the statute are to take their ordinary, contemporary, common meaning. "Courts should not read into the patent laws limitations and conditions which the legislature has not expressed." The court cited the 1952 Patent Act and related reports which

stated that Congress intended statutory subject matter to "include anything under the sun that is made by man".

The invention here is a process; transformation and reduction of an article to a different state or thing is required for the patenting of a process claim that does not include particular machines. Respondent's claims describe in detail a step by step method for accomplishing the transformation of raw, uncured synthetic rubber, into a different state or thing. This is clearly patentable.

In Benson, the sole practical application of the algorithm was in connection with the programming of a digital computer. An algorithm is a procedure for solving a given type of mathematical problem and is like a law of nature which cannot be the subject of a patent. Recognizing that an algorithm need not involve a mathematical formula, for purposes of applying the precedents the court explicitly holds its prior rulings to this narrow definition of an algorithm.

In reviewing its decision in Flook, the court states that Flook's claims were drawn to an alarm limit, a number. The claim merely provided a formula for computing an updated alarm limit. It did not provide any disclosure relating to the chemical processes at work, the means of setting off an alarm, the means for adjusting an alarm system, or the means for obtaining some of the variables required by the formula. The court concluded that Flook

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sought to patent a formula for computing the alarm limit number. Here, Diehr seeks not to patent a mathematical formula, but rather to patent a process for curing synthetic rubber. "Arrhenius' equation is not patentable in isolation, but when a process for curing rubber is devised which incorporates it in a more efficient solution of the equation, that process is at the very least not barred at the threshold by section 101." The theory is that a scientific truth is not patentable but a new and useful structure created with it may be.

The PTO bases its claim of nonpatentable subject matter on the dissection of the claim into old and new art. The Supreme Court explicitly disclaims that Flook allows this dissection. Claims cannot be dissected for old and new. The novelty of any steps in a process or of the entire process is not relevant in determining whether subject matter falls within the section 101 categories of possibly patentable subject matter. In Flook, the court covered up its dissection by claiming that the patent laws were not intended to cover some things (i.e., ideas). Here, anything under the sun, created by man, is said to be patentable subject matter.

The Supreme Court finds the language 'new and useful' in section 101 notwithstanding, the question of whether a particular invention is novel is wholly apart from whether the invention falls into a category of statutory subject

matter. A rejection of a patent application on the
conditions of novelty (section 102), or obviousness
(section 103) does not affect the determination of
patentable subject matter under section 101. Holding: the
decision of the CCPA granting the patent is affirmed
because the claims do not attempt to patent a mathematical
formula but rather are drawn to a process for molding
rubber products

Dissenting Opinion - Diamond v. Diehr

The dissenters claim that the court's decision in this
case rests on a misreading of the patent application and
that the court compounded its error by ignoring the
critical distinction between the character of the subject
matter that the inventor claims to be novel - the section
101 issue - and the question whether that subject matter is
in fact novel - the section 102 issue.

The dissenters blame the CCPA for doing away with well
established precedents and enlarging the categories of
statutory subject matter (to include computer programs
which would have been nonstatutory with the precedents
intact). They claim that the CCPA replaced the overruled
doctrines with more expansive principles formulated with
computer technology in mind. The Supreme Court has stated
that although the precedents were set before the invention

of computers they (the Supreme Court) would not change precedents without guidance from Congress.

The Flook decision requires that an algorithm be treated as prior art for section 101 purposes; the claim is then examined to determine whether it discloses some other inventive concept. A process for curing rubber was patented more than 120 years ago. However, Diehr tells nothing of the chemical processes. Diehr does not claim to have discovered anything new about the process for curing synthetic rubber.

The majority reads Diehr's claims as a method for constantly measuring the actual temperature inside a rubber molding press. The dissenters read the claim as an improved method of calculating the time that the mold should remain closed during the curing process. There is nothing in the claims that cite the novelty of the temperature measuring apparatus, there is nothing novel about constantly measuring temperature, and the PTO found novelty only in the calculation steps (a finding not disputed by the CCPA). There is nothing novel in the instrumentation used, the setting of the timer, or the opening of the mold. "What they claim to have discovered, in essence, is a method of updating the original estimated curing time by repetitively recalculating that time pursuant to a well known mathematical formula in response to variations in temperature within the mold. Their method

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... is strikingly reminiscent of the method of updating
alarm limits that Dale Flook sought to patent."

The dissenters return to the Flook argument of
determining what type of discovery is sought to be patented
(i.e., the intent of the Patent Act) prior to determining
if the discovery is new or obvious. As in Flook, if the
only concept that the inventor claims to have discovered is
not patentable subject matter, section 101 requires that
the application be rejected without reaching any issue
under section 102.

The majority claims that the insignificant post-
solution activity in Flook distinguishes that case from
Diehr. The dissenters claim that Flook's post-solution
activity is no less significant than Diehr's, yet in
neither case should that activity have any legal
significance because it does not constitute a part of the
inventive concept that applicants claim to have
discovered. If the algorithm in Diehr is considered part
of the prior art as precedent requires, then the
application contains no claim of patentable invention
(because it is not novel).

The dissenters recognize that the Supreme Court is not
competent to address the policy considerations necessary to
determine of programs should be patented. However, they
feel that the Supreme Court should be establishing rules
that would enable patent lawyers to determine, fairly

accurately, which, if any program related inventions will be patentable. The dissenters believe that the Supreme Court decisions to date have not yet provided this guidance.

In re Abele
684 F.2d 902 (C.C.P.A. 1982)

This invention claims to improve computed tomography (CAT-scan) whereby exposure to x-rays are reduced while the reliability of image produced is improved. The prior art CAT-scan provides an image representing a transverse slice of the body. This slicing is accomplished by rotating an x-ray source and a detection means around the perimeter of the section to be viewed. The source and detection means are placed 180 degrees from each other to allow the detection means to measure the attenuation of the beam as it passes through the plane of interest. When enough measurements have been taken, a computer is used to mathematically interpret the data, which is then displayed as a reconstruction of the slice on a television screen. If a display of only a subset of the area of a slice is needed (i.e., an internal human organ), the images outside of the subset area are intentionally blurred when the display is created.

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The invention here reduces the width of the x-ray beam
from one that includes the entire transverse slice of the
body, to one that includes only the transverse slice of the
subset area of interest. This method is advantageous
because the body is exposed to less x-ray radiation and the
computer calculation time required to produce the image is
reduced because less data is collected. However, due to
the narrower beam, less data can be collected and there is
insufficient information to cancel out an object that is in
the beam path (i.e., bone). The resulting image shows the
object as an artifact in the image of the desired subset
area. Applicants invention eliminates artifacts by using a
Gaussian weighting function when producing the image.

In rejecting the application, the PTO used the
following test which it claims was mandated by the Supreme
Court in Parker v. Flook: "Taking each claim as a whole,
it is assumed, for analysis purposes only, that any
mathematical calculation in the claim is part of the prior
art. If what is left is new and unobvious, then the claim,
taken as a whole, protects more than a mathematical
calculation and it is deemed statutory. But if the
remainder of the claim is not novel nor unobvious, then the
claim, taken as a whole, merely seeks to protect the
mathematical calculation and, as such, does not comprise
statutory subject matter." After applying this test, the
PTO concluded that, apart from the mathematical

calculations, the remaining steps were well known or were merely a necessary antecedent step to provide values for solving the mathematical equations and thus were directed to nonstatutory subject matter. The CCPA rejects this reading of Flook and claims that the Supreme Court also rejected this reasoning in Diamond v. Diehr.

The PTBA rejected the application on the basis of a test given in In re Freeman, 573 F.2d 1237 (C.C.P.A. 1978), as modified by In re Walter, 618 F.2d 785 (C.C.P.A. 1980). The basis for this test is the definition of an algorithm given by the Supreme Court in Gottschalk v. Benson. It defined an algorithm as "[a] procedure for solving a given type of mathematical problem." Later, in Diamond v. Diehr the court conceded that, in general, an algorithm need not involve a mathematical formula, however it emphasized that its holdings must be applied to this narrow definition. In re Freeman introduced the following test for statutory subject matter: "First, it must be determined whether the claim directly or indirectly recites an "algorithm" in the Benson sense of that term .... Second, the claim must be further analyzed to ascertain whether in its entirety it wholly preempts that algorithm." Subsequent to Freeman, in Parker v. Flook, the Supreme Court found the second part of the Freeman test erroneous holding that the claim need not cover every conceivable application of the formula to be nonstatutory. Therefore, a claim does not present

patentable subject matter if it would wholly preempt an algorithm (from Benson), or if it would preempt the algorithm but for limiting its use to a particular technological environment (from Flook). The second part of the Freeman test was modified in In re Walter to become: "If it appears that the mathematical algorithm is implemented in a specific manner to define structural relationships between the physical elements of the claim (in apparatus claims) or to refine or limit claim steps (in process claims), the claim being otherwise statutory, the claim passes muster under section 101. However, if the mathematical algorithm is merely presented and solved by the claimed invention, as was the case in Benson and Flook, and is not applied in any manner to physical elements or process steps, no amount of post-solution activity will render the claim statutory; nor is it saved by a preamble merely reciting the field of use of the mathematical algorithm." The Walter test is based on the premise that an otherwise statutory process remains statutory when implemented by a computer. This premise was subsequently approved by the Supreme Court in Diamond v. Diehr. After applying Freeman-Walter test to the improved CAT-scan invention here, the PTBA concluded that "... the mathematical algorithm is not implemented in a manner to define structural relationships between physical elements in the apparatus claims or to refine or limit claim steps

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in the process claims. The claims do no more than present and solve a mathematical algorithm and are manifestly nonstatutory." The CCPA rejected the PTBA conclusion finding that the PTBA's analysis in applying the second step of the test was too limited.

The Freeman-Walter test sets forth two ends of a spectrum. What are now clearly nonstatutory are claims in which an algorithm is merely presented and solved by the claimed invention (preemption). What are now clearly statutory are claims in which an algorithm is implemented in a specific manner to define structural relationships between the physical elements of the claim (in an apparatus claim) or to refine or limit claim steps (in a process). The CCPA emphasized that the analysis step from Walter does not limit patentable subject matter to claims in which structural relationships or process steps are defined, limited, or refined by the application of the algorithm. Rather, Walter should be read as requiring no more than that the algorithm be applied in any manner to physical elements or process steps provided that the application is circumscribed by more than a field of use limitation or non-essential post-solution activity. Thus, if the claim would be otherwise statutory, albeit inoperative or less useful without the algorithm, the claim likewise presents statutory subject matter when the algorithm is included. The purpose of this two part analysis is to answer the

question "What did applicants invent?" If the claimed
invention is a mathematical algorithm, it is improper
subject matter for patent protection, whereas if the
claimed invention is an application of the algorithm,
section 101 will not bar the grant of a patent. The
claimed invention, as a whole, must be evaluated for what
it is.

In this case applicants concede that their claims
implement a mathematical algorithm. Therefore, all claims
are potentially nonstatutory subject matter and as such the
second part of the analysis must be applied. In applying
this analysis, the court finds claim 5 nonstatutory and
claim 6 statutory. Claim 5 states: "A method of displaying
data in a field comprising the steps of [1] calculating the
difference between the local value of the data at a data
point in the field and the average value of the data in a
region of the field which surrounds said point for each
point in said field and [2] displaying the value of said
difference as a signed gray scale at a point in a picture
which corresponds to said data point." Claim 6 states:
"The method of claim 5 wherein said data is x-ray
attenuation data produced in a two dimensional field by a
computed tomography scanner." The court finds that claim 5
presents no more than the calculation of a number and
display of the result, albeit in a particular format. The
specification provides no greater meaning to "data in a

field" than a matrix of numbers regardless of by what method generated. Thus the algorithm is neither explicitly nor implicitly applied to any certain process. The method of claim 6, unlike that of claim 5, requires "x-ray attenuation data." The specification indicates that such attenuation data is available only when an x-ray beam is produced by a CAT scanner, passed through an object, and detected upon its exit. Only after these steps have been completed is the algorithm performed and the resultant modified data displayed in the required format. If the claim were viewed without the algorithm, the production, detection, and display steps would still be present and would result in a conventional CAT-scan process. Claim 6 presents data gathering steps not dictated by the algorithm but by other limitations which require certain antecedent steps that dictate what type of data must be obtained. This is contrasted to Flook where the patent application did not explain how to select any of the variables used in the algorithm. In this case, claim 6 defines the variables and places the algorithm in a particular relationship to a series of steps in a particular type of process, permitting the algorithm to be applied as a further process step.

The opinion applies the Walter analysis to other claims and concludes with the holding that claims 5 and 7 are nonstatutory (nonpatentable) and that all other claims are statutory (patentable).

In re Abele - Dissenting Opinion

One of the five judges filed this dissenting opinion.
Each claim as a whole should be examined under section 101
by looking beyond the limitations directed to a
mathematical algorithm and determining whether the
remainder of the claim is directed to statutory subject
matter. If it is, then the mere inclusion of a
mathematical formula or algorithm would not require a
rejection under section 101. Claims 5 and 7 describe
"displaying the [calculated] value ... as a signed gray
scale [i.e., shade of gray] at a point in a picture..."
This judge is "persuaded that such a display is essentially
different from a display of a number calculated by a
mathematical algorithm and that, absent the algorithm, the
shade of gray display at a point in a picture is a
patentable subject matter." This judge would find claims 5
and 7 statutory.

In re Pardo

684 F.2d 912 (C.C.P.A. 1982)

The invention is a method for controlling the internal
operations of a computer. The invention converts a
computer from a sequential processor (which executes
program instructions in the order in which they are
presented) to a processor which is not dependent on the

order in which it receives program steps. This capability is important when the execution of certain program steps requires as a condition precedent the results of other program steps. For example, suppose a user provides the following information:

(1) values for a, b, c, and d

(2) A=X+Y

(3) X=a+b

(4) Y=c+d

Obviously, a computer cannot execute these operations in the order presented. The invention here re-arranges the order of the formulae as presented by the user so that the computer can execute the operations. The invention would change the order of the above equations to be (1), (3), (4), (2).

On July 28, 1972 the PTO indicated that all claims were valid. However, subsequent to the decision in Gottschalk v. Benson, the PTO rejected the claims, as being nonstatutory subject matter. The PTBA, finding the term 'algorithm' in the patent application, concluded that the application is drawn to nonstatutory subject matter. The PTBA also found some claims to be obvious.

The issues before the CCPA are whether Pardo's claims are statutory subject matter and whether the invention would be obvious to a person of ordinary skill in the art on August 12, 1970 (the date of the application). The

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court applies the Freeman-Walter test: "First, the claim is analyzed to determine whether a mathematical algorithm is directly or indirectly recited. Next, if a mathematical algorithm is found, the claim as a whole is further analyzed to determine whether the algorithm is applied in any manner to physical elements of process steps, and, if it is, it passes muster under section 101." A mathematical algorithm is defined as a procedure for solving a given type of mathematical problem.

The CCPA finds that Pardo filed his patent application containing the word "algorithm" more than two years before the decision in Gottschalk v. Benson, where the court used the word in a limited sense to describe nonstatutory subject matter. There is no indication that 'algorithm,' as used by Pardo, means mathematical algorithm as that term has been used by the Supreme Court. Therefore, Pardo's use of the term to describe their invention is not an admission that they are claiming nonstatutory subject matter.

The CCPA finds that none of the claims recite a mathematical algorithm nor do they recite any other judicially determined exception to the section 101 statutory subject matter. As such, they constitute statutory subject matter.

In considering the obviousness issue raised by the PTBA, the CCPA noted that the PTBA did not cite references to support its holding. The CCPA requires that "Assertions

of technical facts in areas of esoteric technology must always be supported by citation to some reference work recognized as standard in the pertinent art and the appellant given, in the PTO, the opportunity to challenge the correctness of the assertion or the notoriety or repute of the cited reference." In making the obviousness rejection, the PTBA failed to follow the three-pronged analysis required. The PTBA did not determine the scope and content of the prior art or even indicate that there was any prior art; it did not determine the differences between the prior art and the claimed invention; and it did not ascertain the level of ordinary skill in the art at the time the invention was made.

Holding: the invention is related to statutory subject matter and the PTO failed to establish that the claims would have been obvious to a person of ordinary skill in the art on August 12, 1970. The PTBA decision is reversed.

ANALYSIS AND EVALUATION

To apply for a software patent, the software must be claimed as a process or an apparatus. If the software performs mathematical calculations, the claims must not preempt use of the algorithm and the invention must pass the Freeman-Walter test. The Freeman-Walter test requires that the claims be otherwise statutory, albeit inoperative or less useful without the algorithm. Otherwise the invention is considered to be the algorithm, which is unpatentable subject matter.

The cases indicate different types of software that might be granted patent protection: a program embedded in a process that transforms an article to a different state or thing (as in Diehr), a program that controls the internal operations of a programmed computer (as in Pardo), and a microcode program embedded in an apparatus (as in Bradley).

The Supreme Court admits that it has not provided guidance for potential software patent applicants. It has stated that unless Congressional guidance is given, it will not re-interpret its patent precedents in light of new computer technology. Congress has not yet provided any guidance.

The PTO and PTBA have rejected most applications containing software related claims. The CCPA/CAFC has reversed many of the PTBA's rejections of software related patent applications. The Supreme Court's action on software related applications is inconclusive.

Unlike copyright cases, patent cases have not distinguished between source and object code or between applications and operating system programs. The court is more interested in the process or apparatus as a whole rather than the software.

A patent protects against independent discovery. However, the protection is for a shorter duration, is more expensive to obtain, and takes a longer time to obtain than copyright protection. Pardo's patent application was submitted on 12 August 1970. The Supreme Court handed down its decision on 5 August 1982. Patent registration procedures require that the invention be disclosed to the extent that it can be duplicated. Copyright deposit requirements allow a deposit of a subset of the work.

The opinions show that the court investigated more of the details of software form and coding when determining if software qualified for copyright protection than it did when determining patent qualification. Patent qualification relied on tests like the Freeman-Walter test which examined only the overall function of the software and ignored the method of accomplishing that function.

Flook's alarm limit program and Diehr's cure time program appear to be essentially the same program except for the mathematical formula. They both input numbers, use the numbers in an equation, and then output the number that results from the calculation. This indicates that the 'packaging' of the software in a patent application may be more important than the software's operation. This theory is reinforced in Abele where claim 5 is rejected as nonstatutory while claim 6, which applies specific data to the method of claim 5, is accepted. Bradley's Switch System Base appears to be of limited use (possibly too limited to pass patent usefulness requirements) because it does not offer the user more benefit than the methods it was designed to replace. Pardo's invention appears to be an algorithm (in the general, non-Benson sense). Mathematical equations would be derived in the proper execution sequence and there would be no need for Pardo's invention. The court determined that Johnston's software was obvious yet failed to recognize the obviousness/uselessness of Bradley's and Pardo's inventions. The bank statement produced by Johnston's invention was familiar to the judges. However, they are probably not familiar with the computer operations produced by Bradley's and Pardo's inventions. Unlike the copyright cases, none of the patent cases involved infringement where two programs had to be compared for similarity. Most of

the judicial decisions are based on the software's externally visible function rather than its method of operation.

"Even with these guidelines and the decisions of the Supreme Court the patentability of software programs remains confusing as ever, especially with the inclusion of the concept of an algorithm within the laws of unpatentable subject matter." (19:493). "Without considering the details of the patentability argument for computer software, it is evident that the patent system is not the best mode of protection available for most commercial computer software packages." (19:493).

IV. TRADE SECRET PROTECTION

INTRODUCTION

This chapter reviews the protection available to
software under the state and common laws of trade secret
misappropriation. Unlike copyright and patent law, trade
secret law is not governed by federal statute. Each state
may enact its own trade secret laws. Trade secret law,
tort law, and contract law are all involved in trade secret
protection. The trade secret facts presented here are
taken from several jurisdictions to illustrate the
fundamental principles.

BACKGROUND

A trade secret is defined as any formula, device, or
compilation of information which is used in business, and
which gives the owner an opportunity to obtain an advantage
over competitors who do not know or use it (25:52).
Factors considered by courts in determining if given
information is a trade secret are: 1) the extent to which
the information is known outside the owner's business, 2)
the extent to which it is known by employees and others
involved in the business, 3) the extent of measures taken
by the owner to guard the secrecy of the information, 4)
the value of the information to the owner and to
competitors, 5) the amount of effort or money expended by

the owner in developing the information, and 6) the ease or
difficulty with which the information could be properly
acquired or duplicated by others (24:5.3). The software
elements generally found protectable by trade secret are a
program's unique principles, engineering, logic, and
coherence. (24:5.8)

A trade secret is lost by independent discovery or
other legitimate means of determining the secret.
Legitimate means include reverse engineering and the
information becoming public knowledge, such as when the
owner fails to take reasonable precautions to protect it
(24:5.10). Once secrecy is lost, there is no trade secret
protection for the program.

Unlike federal patent and copyright laws which share a
common foundation in the Constitution, there are no federal
trade secret laws. Each state may enact its own trade
secret laws. The trade secret laws listed in this chapter
are collected from various jurisdictions to illustrate the
fundamental principles. Trade secret protection is
dependent upon contract and tort law. In August 1979, the
National Conference of Commissioners on Uniform State Laws
approved the Uniform Trade Secrets Act. Under the Act,
"trade secret" means information, including a formula,
pattern, compilation, program, device, method, technique,
or process, that: (i) derives independent economic value,
actual or potential, from not being generally known to, and

not being readily ascertainable by proper means by other persons who can obtain economic value from its disclosure or use, and (ii) is the subject of efforts that are reasonable under the circumstances to maintain its secrecy. Although not mandatory, this act has been adopted in several states (24:5.4).

Trade secret protection differs in theory from patent and copyright protection. Trade secret cases are more concerned with the acts of humans rather than the details of the item considered a trade secret. Software related trade secret theory is usually based on a contract not to use or disclose, or a confidential relationship. The basis of protection is the existence of a relationship between the trade secret owner and the one using or disclosing the trade secret (or threatening to do so). This relationship can be created by an express contract, such as a license agreement or employee nondisclosure agreement, or it can be implied from such relationships between the parties as joint venturer, employer-employee, manufacturer-independent contractor, or vendor-vendee (24:5.9).

Trade secret and copyright protection can co-exist as long as the owner is not seeking to enforce the same or a substantially equivalent right under state law as would be provided under federal copyright protection. This would allow the idea or method of a copyrighted computer program to be protected under trade secret law since ideas,

processes, and concepts may not be copyrighted (25:62).
During consideration of the 1980 amendments to the 1976
Copyright Act, the House Report concluded that there should
no trade secret preemption by the copyright laws (provided
trade secret law does not attempt to govern areas that fall
under copyright law) (24:5.12). The Supreme Court has
found that patent and trade secret law are not now and
never would be in conflict (24:5.11).

Unlike patent and copyright law, which exist primarily
to encourage creation and disclosure, trade secret law
exists to maintain standards of commercial ethics as well
as to encourage invention (24:5.4).

For subject matter to be considered a trade secret it
must be kept secret. However, it is not necessary that a
trade secret be absolutely secret, qualified secrecy is
sufficient (24:5.5). The determination of whether secrecy
exists is a question of fact as opposed to a question of
law (24:5.5). When trade secret software is marketed, the
quality of the precautions, not the number of licensees,
determines if secrecy has been maintained. Typical
protective steps taken by trade secret owners include: 1)
use of a license agreement under which the licensee obtains
only limited rights in the software, rather than an
outright sale of the software, 2) prohibition on the
copying of the software except for use and archival
purposes, with restrictions on the maintenance and disposal

of all copies, 3) restrictions on disclosure of the secret information by the licensee, 4) limitations on the use of the software to a single CPU or single physical location, 5) distribution of the software only in machine-readable (object code), not human-readable (source code) form, 6) special coding techniques to assist in the identification of misappropriated software (i.e., ownership notices embedded in object code), 7) a requirement that the licensee notify the licensor of any unauthorized use or disclosure, and 8) prohibition on disassembly and decompilation (24:5.7).

The only protection provided by trade secret law is the execution of legal recourse to prevent someone from using or disclosing the secret where there has been a breach of confidence, where there has been a discovery through improper means, or where the secret was learned through a third party who obtained it improperly through a breach of confidence (25:62). The immediate institution of litigation against the misappropriator of trade secrets is the only effective way to protect against the loss of a trade secret (24:5.14).

At trial, the owner of a trade secret must establish the existence of a trade secret by showing the court that the subject matter is maintained in secrecy, that the subject matter is not generally known in the trade, and that the subject matter gives its owner a competitive

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advantage over those who do not know or use it (24:5.5). To establish an actionable wrong, the owner of the trade secret must show the existence of a contractual or confidential relationship between the owner and the one using or disclosing the trade secret, under which such use or disclosure is improper (24:5.5). Lack of secrecy is one of the chief defenses raised to trade secret misappropriation claims (24:5.7).

One who discloses or uses another's trade secret, without a privilege to do so, is liable to the other if 1) he discovered the secret by improper means, 2) his disclosure or use constitutes a breach of confidence reposed in him by the other in disclosing the secret to him, 3) he learned the secret from a third person with notice of the fact that it was secret and that the third person discovered it by improper means or that the third person's disclosure of it was otherwise a breach of his duty to the other, or 4) he learned the secret with notice of the fact that it was a secret and that its disclosure was made to him by mistake (20:26-27).

Types of evidence generally presented in software trade secret cases include: 1) substantial similarities between plaintiff's and defendant's program code, which can be established through the use of expert witnesses, 2) the existence of common errors, unique sequences of instructions, or other identifying characteristics, and 3)

the fact that the defendant was able to bring its software
to market in a fraction of the time and at a fraction of
the cost incurred by plaintiff, particularly where the
defendant company is formed by or has hired away key
employees of plaintiff just prior to introducing its
competitive product (24:5.16). To protect the trade secret
during trial, the plaintiff should request that the
proceedings be held in private (in camera) (24:5.17).

CASE REVIEW

The trade secret cases illustrate different types of confidentiality agreements upon which trade secret protection is based. Unlike copyright and patent cases, human behavior is the primary issue in the trial rather than the the software or other object to be protected. The legal issues of determining if a trade secret exists and if that secret has been misappropriated center on the handling of the article considered to be a trade secret. The form of the software (i.e., source code, object code, operating system, application program, algorithm, apparatus, or process, system) is not a factor in determining if trade secret protection exists.

Servo Corp. v. General Electric Co.
393 F.2d 551 (4th Cir. 1968)

This case does not involve computer software, however, it states some principles of trade secret law. In a trade secret misappropriation case the court must first determine if a trade secret exists. It will examine the information released to the public by the plaintiff to determine if the information released is sufficient to allow competitors to ascertain all parts of the trade secret. If so, no trade secret exists. If a trade secret has been misappropriated, damages are awarded only for the parts of the trade secret not previously disclosed by the owner. The mere presence

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in the public domain of the information on which a trade secret is based does not preclude recovery for a breach of the trade secret.

Com-Share, Inc., v. Computer Complex, Inc.
338 F. Supp. 1229 (E.D. Mich. 1971)

Plaintiff and defendant entered into an agreement to share software for a particular computer system. The agreement included a clause not to divulge the shared information for twenty-four months after termination of the agreement. By mutual consent, the agreement was terminated on 1 November 1970. On 5 August 1971, defendant agreed to sell its assets to another company. On 27 August 1971, plaintiff brought suit claiming breach of the non-disclosure agreement.

Defendant claims that the programs supplied to it by plaintiff were in the public domain and do not constitute a trade secret. The court accepts plaintiff's claim that its version of the software has been modified to support more users than the version in the public domain, and as such plaintiff has applied new principles and unique engineering to the programs that had previously been in the public domain. The programs are now plaintiff's property.

Defendant claims that it modified the programs it received from plaintiff and that it owns the programs. The court finds that "It is necessary to note that the existing

software systems which are unique in the computer time sharing industry all contain certain elements which perform similar functions and many utilize certain similar fundamental concepts, of a general nature. This is no more than saying that all have a common concept, and, in the most general sense, a common base. While it is true that defendant may have made certain technical changes in software supplied to it by plaintiff, under the Technical Exchange Agreement, the defendant did not alter the unique principles, engineering, logic, and coherence developed by plaintiff into such software systems."

The court finds that plaintiff adequately protected the programs with user access passwords, physical security of the media containing the programs, and database access controls for customers and employees. Holding: defendant cannot lease, sell, or transfer any of its software that it cannot separate from the software it received from plaintiff for twenty four months from the termination of the agreement.

University Computing Co. v. Lykes-Youngstown Corp.

504 F.2d 518 (5th Cir. 1974)

Defendant admits improperly obtaining a trade secret program from plaintiff. In determining that the program is a trade secret, the court used evidence showing that the program has unique capabilities and features that make it a valuable competitive product.

Having determined that a trade secret exists and that misappropriation has occurred, the court must determine the amount of damages to award to plaintiff. The measure of damages in trade secret appropriation is established by the analogous line of cases involving patent infringement. When secrecy has not been lost and plaintiff is unable to prove specific injury, the value of the secret to the defendant is used in determining damages. Holding: plaintiff is awarded $392,000 damages plus attorneys fees for misappropriation of its trade secret.

U.S. v. Seidlitz

589 F.2d 152 (4th Cir. 1978)

Defendant, a former employee of OSI, responsible for computer access security, used passwords learned during his employment to remotely access the company's computer and take a copy of the source code for a text editor. Defendant admits taking the code but claims that it is in the public domain. OSI supplied evidence that was used by

the court to determine that the company invested
substantial sums to modify the software to suit its
particular needs and that these modifications gave the
company a multi-million dollar competitive advantage. The
court accepted OSI evidence that adequate measures were
taken to maintain the secrecy of the software.

The court finds that it is of no consequence that
defendant never used the misappropriated software in his
own business and that he never tried to sell it to others.
Holding: the trial court's finding of fraud by wire is
affirmed.

Warrington Associates, Inc. v. Real-Time Engineering
Systems, Inc.
522 F. Supp. 367 (N.D. Ill. 1981)

The issue here is whether plaintiff's manual may be
protected as a trade secret. The manual is registered with
the copyright office as an unpublished document and is only
disclosed to customers who sign a confidentiality
agreement. Defendant requests summary judgement claiming
that copyright registration destroys secrecy.

In determining if copyright protection preempts trade
secret protection the court notes that trade secret
protection extends to ideas and that copyrights do not
protect ideas. The court cites a House report stating that
the Copyright Act does not preempt trade secret protection

so long as the causes of action (reasons for litigation) contain elements of breach of trust of confidentiality. Holding: although copyright protection does not in itself destroy secrecy, the fact that the manual is registered for copyright protection might affect continued secrecy of the ideas in the manual for which trade secret protection is sought. This issue must be determined at a trial on the merits. Summary judgement denied.

Moore v. Honeywell Information Systems
558 F. Supp. 1229 (D. Hawaii 1983)

Husband and wife (Moore) were employed by Honeywell. The Honeywell employment contract prohibits employees and immediate family from engaging in activities in conflict with their employment responsibilities. The contract defines immediate family as relatives not more distant than first cousin. Holding office in a competing company is defined as being in conflict with employment responsibilities.

While employed by Honeywell, the Moores formed their own computer company with themselves as officers. Honeywell asked them to divest of their interest in their company. The wife divested but the husband did not. Both were released from employment with Honeywell.

The Moores claim that their employment was unjustly terminated since their company sells small computers and does not directly compete with Honeywell (Honeywell does not sell small computers in Hawaii, where they reside and are employed). The court finds that the two businesses need not be directly competing in the same geographic or product market in order for Honeywell to properly invoke its conflict of interest policy. "Honeywell is undoubtedly in possession of valuable trade secrets, such as software programs, marketing techniques, market studies, and other information developed perhaps at great cost to the company." The employment policy here seems to be reasonable to prevent the improper and unauthorized use of such information by persons or businesses which may unjustly benefit themselves with such information. Holding: summary judgement for Honeywell.

Videotronics, Inc. v. Bend Electronics, Video Horizon, Inc., Tom Hendrix, Bill Stanard, and Ross Brown

564 F. Supp. 1471 (D. Nev. 1983)

Defendants admit copying a video game which plaintiff claims is its trade secret. Plaintiff distributed video games to defendant for public sale. There was no written agreement between plaintiff and defendant containing any requirement that defendants maintain secrecy as to any of the equipment, programs, or the design of the equipment

which plaintiff supplied to defendant. Plaintiff requests
a preliminary injunction prohibiting defendant from
marketing its copies of plaintiff's video game.

The issue here is whether the contested video game is
a trade secret. The court lists the requirements for the
existence of a trade secret but makes no determination of
whether a trade secret exists. The court states that the
issues here involve material (computer programs) that is
protected by federal law (copyright) and is therefore
preempted from state protection. Holding: because the
court has found that the plaintiff's property interest in
the computer programs contained in its electronic video
device is covered by the Copyright Act, relief under the
state common law doctrines of misappropriation and trade
secret cannot be obtained here. Preliminary injunction
denied.

Dickerman Associates v. Tiverton Bottled Gas Company, Brian
Vaill, Dealers Management Services, Inc.
564 F. Supp. 30 (D. Mass. 1984)
This opinion is reprinted in Appendix E.

Vaill, former manager of Tiverton, and now part owner
of Dealers Management Services (DMS), is accused of copying
plaintiff's JMS software. As manager of Tiverton, Vaill
purchased JMS for Tiverton.

All purchasers of JMS were required to sign an agreement to treat all supplied materials as confidential. When JMS was demonstrated for potential customers, the information released was too limited to allow an understanding of the program's design and architecture. The court finds plaintiff's protection of its trade secret sufficient to maintain secrecy.

Vaill and DeYoung (an employee of DMS) developed FP, a software program that performs the same function as JMS. Plaintiff seeks a preliminary injunction to prohibit DMS from marketing FP. FP was developed in 6 man months. JMS had required 34 man months and cost $400,000 to develop. In comparing JMS and FP, the court examined menus, suboptions, screen formats, the sequence of submenus, and testimony of expert witnesses who claimed that the similarities between JMS and FP are not accidental. Design notes of Vaill and DeYoung show numerous items in FP which are remarkably similar to JMS. Here, as in some copyright infringement cases, the court compares the program's human interfaces to determine infringement. This is not a valid method of determining infringement since the human interface is easier to change (for the purpose of concealing infringement) than the program's internal operations. The comparison of the design notes is a more valid comparison since it includes the internal operations of the programs.

Based on the similarities of JMS and FP, Vaill's and DeYoung's design notes, the availability of JMS material to Vaill and DeYoung, and the speed in which FP was completed the court concluded that Vaill and DeYoung copied JMS. Holding: preliminary injunction granted.

Business Intelligence Services, Inc. v. Hudson
580 F. Supp. 1068 (S.D.N.Y. 1984)

Hudson, an employee of Business Intelligence Services (BIS), signed a contract with BIS, agreeing not to work for a competitor for a period of twelve months after the termination of her employment with BIS. Hudson left BIS with the intention of working for MTI, a competitor of BIS. BIS brought suit to stop the employment.

The court finds that a non-competition agreement is enforceable if the restriction is reasonable in scope and duration and is necessary to protect against the disclosure of trade secrets or other confidential information, or solicitation of customers, or when the employees services are unique or extraordinary. The court finds that computer software and client information are protectable as a trade secret and that the one year limit on Hudson's employment is not unreasonable because of BIS's expense and effort in developing their product and because of Hudson's knowledge of that product. The unlimited geographic limit on Hudson is not unreasonable because BIS is an international

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company. Holding: Hudson is enjoined from commencing employment with MTI for 1 year from the termination of her employment from BIS.

ANALYSIS AND EVALUATION

Computer programs, without distinction of form (source code, object code, applications program, operating system), may be protected as a trade secret if the requirements for a trade secret are met. Trade secret law requires that the information to be protected provide the owner with a competitive advantage and that the secrecy of the information be maintained. The court has accepted limited access to the trade secret information and a requirement for confidentiality agreements prior to accessing the trade secret information as sufficient proof of maintenance of the trade secret.

The protection provided by trade secret law is the enforcing of agreements that prohibit individuals from divulging or using the trade secret information. The basis for legal action in trade secrets is the breach of a confidential agreement. In Moore v. Honeywell and Business Intelligence Services v. Hudson, the specific information protected by the trade secret was not considered by the court. The employment agreements implied the presence of trade secrets. The ultimate result of trade secret protection is that information which gives the owner a competitive advantage, is maintained as a secret by the owner and those who enter into a confidentiality agreement. Trade secret law does not protect against

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independent discovery or reverse engineering (12:149).
When secrecy is lost, trade secret protection is lost.

A copyright grants the owner certain exclusive rights,
among them are the right to make copies and the right to
prepare derivative works. The owner of a trade secret, by
virtue of the secrecy of the information, also has these
rights.

Patents grant a monopoly to the owner of the patent.
Others are prohibited from manufacturing or using the
patented object. While secrecy is maintained, the owner of
a trade secret has the same protection. The patent owner
is protected even if there is independent discovery. The
trade secret owner has no protection against independent
discovery or loss of secrecy

Trade secret laws are of no use to the Air Force in
protecting its software. A requirement for the existence
of a trade secret is that the material composing the secret
must give the owner an advantage over competitors who do
not know the secret. The government is a service
organization whose only competitors are foreign
governments. Information that the U.S. government wants to
keep from other governments is put on the export control
list, the munitions list, or is classified. Government
secrets are protected by federal laws which preempt state
trade secret laws. When a contractor provides the
government with trade secret material, that material is

declared to be limited rights technical data. The government is responsible for maintaining the secrecy of that material

The areas of trade secret preemption by patent and copyright protection are not firmly resolved. Federal law preempts state law whenever the two govern the same item or action. Therefore, copyright or patent protection can be used with trade secret protection as long as the rights asserted under the trade secret laws are not covered by copyright or patent laws. Copyright protects expression (the sequence of instructions in a program) while trade secret law can be used to protect ideas. In Videotronics v. Bend Electronics, the court made a broad decision that computer programs may be copyrighted and hence cannot be protected by trade secret law. However other cases, including Warrington Associates v. Real Time Engineering, have found that neither Congress nor the courts have viewed the federal copyright act as preempting the common law of trade secret misappropriation (11:272-274).

As in copyright cases, when the court had to compare software programs to determine if one was a copy of the other, it looked at menu formats, suboptions, data items, and other external features. The court did not attempt to examine the source code or the internal structure of the program.

V. ANALYTICAL RESULTS

This chapter summarizes the contemporary approaches that industry and the government use to protect software. This information is taken from conversations with industry and government attorneys who are responsible for obtaining protection for their companies. The chapter concludes with recommendations for improving the legal of protection of software.

Current Industry Practice In Protecting Software

Software industries use a combination of methods to protect their software. The methods used depend on the development costs, marketing methods, and intended use. Trade secret law provides the most protection and is the preferred method. Unlike patents and copyrights, there is no disclosure of the software through a public deposit. However, marketing methods and the intended use for the software may make the maintenance of secrecy infeasible. Patents provide more protection than copyrights and are used if the software meets the patentability requirements. Copyright protection is easily obtained and is used with trade secret protection, or is used alone if no other form of protection is available. Smaller companies cannot financially afford the cost of patent registration and the

security requirements of trade secret protection and therefore must rely entirely on copyright protection.

Although infringement is difficult to detect, when it is detected companies will prosecute to the fullest extent. They hope that by prosecuting when possible, other companies will not infringe for fear of an lawsuit. The adverse publicity and fines that result from a lawsuit are detrimental to business. Infringement may be detected when a company with multiple computers, purchases an insufficient number copies of a software product that is licensed by machine. After infringement is detected and a trial is begun, the party claiming infringement must convince the court that the alleged infringing software is similar enough to the protected software to constitute infringement. The attorneys must educate the judge(s) on the technical issues, for if the court is to decide on contested technical issues, it must first understand these issues. The attorney who best educates the court will make his/her arguments most easily understood and may benefit from this in the decision.

Government Software Procurement and Development

Federal Acquisition Regulation (FAR), Department of Defense (DOD) Supplement, sections 27.401-27.407, 27.412, and 52.227.7013-52.227.7020 specify the contractual requirements for obtaining copyrights to software procured

by the government. Appendix F contains a diagram summarizing the protection available for government software. The government retains ownership and control of all works produced by a contractor that have been contractually designated as "special works". The contractor retains copyright ownership for works (other than "special works"), first prepared under government contract. For these works and other works acquired under contract, not first prepared, for which the contractor owns the copyright, the government must be granted, and must be authorized to grant to others, a nonexclusive, paid-up, worldwide license for government purposes. Unless written approval of the contracting officer is obtained, the contractor may not include in any work acquired under government contract, a work of authorship in which copyright is not owned by the contractor, without acquiring for the government, a nonexclusive, paid-up, worldwide license for government purposes. The government must also have the right to grant these rights to others. The government does not acquire any rights when off-the-shelf works are procured (unless the right to reproduce the work is an objective of the contract).

The contract clauses specified in DOD FAR Supplement section 52.227-7013 appear to give the government unlimited rights to the software it procures. However, the contractor often includes its own, more restrictive,

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license agreement with the delivered product. The
contractor's license agreement may limit use of the
software to a specific CPU or may restrict copying of the
software. There have been problems because of conflicts
between the government's contract and the contractor's
license agreement but no lawsuits have resulted.

There are usually three groups of government people
involved in software procurement: the user/requestor of the
software, the procurement office, and the contract law
office. The procurement office performs the mechanics of
obtaining the software. The contract law office reviews
the contracts obtained by the procurement office to ensure
conformance with government regulations. The burden of
complying with software protection laws rests with the user
organization. The user organization must ensure that the
software it is requesting is not already available within
the government, that it is not available in the public
domain, and that the software users can and do comply with
the vendor's licence agreement and all applicable software
protection laws. The user organization is responsible for
comparing vendor software with public domain software to
ensure that the vendor's software, if it is similar to
public domain software, has met the copyright requirements
of creativity and investment of effort, before the
government pays for the vendor's software. .

A common occurrence in this procurement method is that the procurement contract and the licence agreements are not reviewed and understood by the user organization. Only the user organization has physical control of the software and therefore, is the only organization capable of complying with the procurement agreements. Neither the procurement office nor the contract law office has personnel who are technically competent to evaluate the user organization's use of the software for compliance with the procurement agreements. Only the user organization can determine if its use of copies of copyrighted works are in compliance with section 117 of the Copyright Act. Section 117 also allows the user to adapt a copyrighted program for use in conjunction with a machine if that adaptation is created as an essential step in the utilization of the computer program. Section 117 requires that the program be used in no other manner. The user, not a procurement officer or a lawyer, must determine if the modifications to copyrighted software are essential adaptations or if they are a derivative work, which is the exclusive right of the copyright owner.

Patent law prohibits independent creation. When the government develops software, it must ensure that its software is not substantially similar to patented software. Only the software development organization has the technical ability to make this determination.

The government could improve its acquisition of software rights in procured software by closely examining the vendor's licence agreements and by developing government licence agreements tailored for the use of the software. The government license agreement would have to be agreeable to the contractor but it need not be the same for all forms of software. The government should have more rights for a targeting system to be used by analysts and maintained by government programmers than for a microcode program embedded in a black box computer that is part of a nonreusable satellite. The government could publish its internally developed software to lessen the possibility that a contractor could develop the same software and sell it to the government. This would also help prevent duplication of development or procurement effort within the government. The government cannot obtain copyrights for the software it develops (17 U.S.C. section 105) but it can apply for patents. Patents should be obtained for qualified software to establish the government's rights to the software and to prevent contractors from making minor modifications and selling the software to the government.

Very rarely is government procured software designated as 'special works'. Government procured software usually has use limitations as designated in the contractor's licence agreement. The validity of these agreements should be determined by a lawyer. Compliance with the conditions

of the procurement contract and valid licence agreements is the responsibility of the user organization.

Recommendations for Improving the Legal Methods

A New Body of Law is Required.

"Although legal commentators addressing the question generally agree that any method of software protection requires some form of copyright and patent law hybrid, there is still much uncertainty about the specific aspects to be drawn from each ... Clearly, to develop such a complex hybrid system will require a great deal of further study and the concern of legislators." (15:132) As was done for semiconductor chips, a new body of law should be created for software protection. This would eliminate the confusion over the patentability of software and would remove a useful work (software) from the copyright laws which are not intended to protect useful works. The patent and copyright clause of the Constitution should be the basis for the new law. It grants exclusive rights to inventors (i.e., software developers) for limited times to promote science and industry by making the inventions public. Federal law provides consistency throughout the country and allows for reciprocity with other governments.

A Patent-Copyright-Trade Secret Derivative System.

To promote software development, the developers must have an opportunity to profit from their investment. Illegal copying and the use of existing software to create similar competing software deters investment in software development. Patent-like protection which grants the owner the exclusive right to make, sell, and use the software should be granted for a period of time sufficient to allow the developers to recover their investment and to allow profit making.

Unlike patent protection, copyright protection is automatic upon fixation in a tangible medium of expression and is provided for all but the most trivial programs (those written without a modicum of creativity). Patent law requires that inventions meet specific qualifications before protection is granted. To offset copyright's unqualified protection, independent creation is allowed. The patent law requirement that qualifications be met prior to protection (qualified protection) and the prohibition against independent creation are recommended. Requirements of usefulness, novelty, and nonobviousness should be applied to software. There is no reason to protect useless software. Software that does not perform a new function or does not enhance existing software does not promote progress and only competes with existing software. The requirement that the software be nonobvious complements the

novelty requirement by prohibiting protection for software that is suggested by existing software or by published works. It seeks to promote significant advances in progress by disallowing protection for trivial enhancements to existing software.

Derivative Works

Copyright law grants the owner the exclusive right to prepare derivative works. For software, this encompasses modifications and extensions of a software product to enhance or increase its features, to increase efficiency, or to extend the use of the software to new hardware or a new operating system. The software developer could be granted the exclusive right to prepare derivative software products for an initial portion of the term of protection of the original product. This would encourage the developer to release the original product early, while derivatives were being prepared. Granting the original developer the exclusive right to prepare derivative works for a shorter period than the term or protection for the original product will promote progress by allowing others to profit by enhancing new software products. Both the original work and all derivative works must meet the requirements of novelty, usefulness, and nonobviousness if they are to be p otected. A derivative work must enhance, extend, or increase the efficiency of the original

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software. If protection is granted for a derivative work, the owner is granted the exclusive rights to make, sell, and use only the derivative work. The exclusive rights to the original software remain with the original developer.

A Method of Evaluating Software for Compliance With Protection Requirements

Qualified protection requires an examining authority, a reviewing authority, and an appeals route to the Supreme Court. The examiners and reviewers should be software experts. They would evaluate the novelty, usefulness, and nonobviousness of the software for which protection is requested. The examiners would be the first level of approval/disapproval for protection applications. The review board would evaluate appeals of the examiners decisions. Only questions of technological fact would be decided by these bodies. Questions of law and questions of fact not relating to software technology could be appealed to a specified appellate court (i.e., Court of Appeals for the Federal Circuit) and then to the Supreme Court. Infringement actions would be initiated at the specified court of appeal. The courts would not decide on questions of technological fact. Questions of technological fact arising during an infringement trial would be answered by the review board.

Registration Process

Registration should not require the assistance of an attorney and should take less time than is currently required for patent registration. A system of software classification based on software function, applicable system(s) (CPU and operating system), and programming language should be used to establish a prior art repository. The applicant would be required to submit results of a prior art search with the application. If similar systems exist, the applicant would have to justify the significance of the improvement of the new software over the prior art software. The examiner would conduct a prior art search and a current art search (the confidential files containing the documents for the software currently protected). If similar software were found the application would be returned to the applicant for justification. If the new invention is rejected because of software under protection, the confidential documents for the currently protected software would have to be made available to the applicant so that he/she could justify the significance of the improvement of his/her software over the current art. The applicant would be required to maintain the confidentiality of these documents. The prior and current art searches and the justification of similarity would be at the software function level. Since many forms of software can be created that perform the same function, the

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function rather than the form (expression) is the basis for protection. The requirement that the software perform a function would prevent the protection of ideas or abstract formulas.

Deposit Requirements and Infringement Evaluation

The secrecy provided by trade secret law appears to be the best means of preventing infringement. Patent and copyright deposit requirements make the invention public upon registration. This proposed method would require a deposit but would keep the deposit confidential until the term of protection ends. To help maintain the secrecy of the method, distribution of the software should be in object code only. Source code, object code, software engineering documents, and financial statements would be have to be deposited. There are no physical methods available to prevent copying or reverse engineering of object code. Therefore, efficient methods of determining infringement and severe statutory damages for infringement are needed. If proper software engineering methods are used to develop the software, relatively little of the developer's investment is in coding. Therefore, more than the sequence of statements must be protected. By requiring deposit of a specified set of software engineering documents, infringement can be determined at the function level by comparing the documents from the original software

with the documents from the alleged infringing software. Appendix J illustrates the software engineering life cycle and the documents that are produced at various steps. As a minimum, the preliminary (logical) design document and the detailed (physical) design document would have to be deposited with the registration office. The source code would only be used to verify that it was actually developed from the deposited design documents. The review of these documents would be done confidentially by the review board. Similarity of design, particularly detailed design, would constitute infringement or independent creation. This method should detect copying and prevent independent creation of similar works while avoiding the tedious job of comparing source code. The financial statements would indicate copying if similar products were developed with substantially dissimilar investments. They would also assist in awarding damages if infringement is found. Upon expiration of protection, the source code, object code, and software engineering documents would become public information to be used to promote progress.

Under this method, Pardo's invention would have been rejected by the examiner and the review board as being obvious and useless. If appealed to a court, the court would use the determination of fact made by the examiner and the review board to uphold the rejection. Bradley's invention may have been found novel, but it would also be

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found to be lacking in utility since it did not provide any more machine independence than assembly language. Franklin's duplication of Apple's operating system programs would have been prohibited under this method. Franklin merely duplicated the functions of Apple's programs, no improvements or enhancements were made. If Franklin had added a new, useful, and nonobvious function to Apple's programs then they could apply for protection for the enhancements. If Franklin had adapted Apple's programs for use on a significantly different architecture, the adaptation could be protected.

A significant enhancement in the performance of a protected work could be protected. The examiner and review board are responsible for making judgement decisions on technical issues. For example, a fifty percent reduction in the amount of CPU time used by a utility program that is run once a month and requires ten seconds of CPU time on a large mainframe would probably not be protected while a ten percent increase in an operating system routine that runs on a small microcomputer and uses forty percent of the total available CPU time for the system, would probably be protected. In the latter case a significant advancement has been made whereas in the former case the improvement is trivial and does not warrant preventing the industry from using it without compensating the inventor.

Summary

The computer industry uses a combination of methods for protecting its software because no single method is sufficient. Having obtained protection, industry's most difficult task is detecting infringement. When infringement is detected, it is prosecuted to the fullest extent to deter potential infringers.

The Air Force is limited more than industry in its methods of software protection. Copyright and trade secret protection cannot be used for Air Force developed software. The Air Force must place the software it develops into the public domain and must rely on the contract provisions dictated in the Federal Acquisition Regulations to ensure that it obtains the rights it needs for commercially prepared software.

The proposed copyright-patent derivative system seeks to provide complete protection for a period of time sufficient to allow the software developer to profit from its investment. It grants the developer a short period for exclusive development of derivative works but then encourages others to prepare derivative works by allowing them to protect those works. The proposed system would protect the software function and would use software experts to decide issues of fact concerning the examination process and infringement.

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VI. CONCLUSIONS

The legal protection provided by copyright, patent, and trade secret law may be used separately and in combination to protect proprietary rights in software. Each form of protection has different requirements for protection and provides a different type of protection. The intended use of a software product should be considered prior to choosing a form of protection. The protection requirements of the different forms may determine which form of protection is feasible for the intended use of the software.

As shown in Chapter II, copyright protection is easier to obtain than patent or trade secret protection. Protection is automatic upon fixation of the work in a tangible medium of expression. All forms of software may be protected (source, object, applications, operating systems). The term of protection is author's life plus 50 years. Copyrights protect only the expression, the idea (algorithm) is not protected. A copyright gives the owner the exclusive right to copy and prepare derivative works. Independent creation of a work identical to a copyrighted work is allowed, and the independently created work may be copyrighted. Reverse engineering (decompilation, disassembly) is not prohibited. Registration requires the submission of a standard form and a $10.00 fee.

Registration is only mandatory for initiation of an infringement lawsuit. A deposit of part of the copyrighted work is required for registration. The owner is responsible for detecting and correcting (through a lawsuit) any infringement. To prove infringement, the owner must show that the alleged infringer had access to the copyrighted material and that the alleged infringing work is substantially similar to the copyrighted work.

Chapter III shows how the availability of patent protection for software depends on the attorney's skill in drafting the claims and the environment in which the software is used. The courts have provided little useful guidance as to which types of software are patentable. A patent grants the owner a virtual monopoly to make, use, and sell the invention. To be patented, an invention must be novel, useful, and nonobvious to a person skilled in the appropriate art. When applying for a patent, software must be claimed as a process or an apparatus. An independently created invention may not be marketed. Reverse engineering is useless because independent creation is prohibited and because registration requires the deposit of sufficiently detailed instructions to allow a person skilled in the art to produce the invention.

The term of protection is 17 years. Patent protection is not automatic, and does not begin until a patent is issued. The application procedure requires the assistance

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of an attorney skilled in the art of drafting patent claims. The processing of the application can take several years. A patent can be revoked if it is proven that the invention did not meet all requirements for the issuance of a patent on the date when the patent was issued. Not all software can be patented. Ideas and mathematical algorithms cannot be patented. However, a useful application of an idea or mathematical algorithm can be patented. The invention containing the mathematical algorithm must not preempt the use of the algorithm and it must pass the Freeman-Walter test. This test requires that the invention considered without the algorithm, must be patentable subject matter. Post-solution limitations and field of use limitations on the invention are not to be considered in applying the test. No similar test exists for programs that do not use a mathematical algorithm.

Chapter IV illustrates how trade secret law relies on human acts in maintaining secrecy to provide protection. The information to be protected as a trade secret must be a secret and it must give the owner a competitive advantage over those who do not know the information. There are no restrictions on the type of information that can be a trade secret. The trade secret information must be maintained in secrecy and all who have access to it must accomplish a confidentiality agreement. Protection exists as long as the information remains a secret and continues to give the

owner a competitive advantage over those who do not know
the information. Protection is obtained through the
enforcement of confidentiality agreements. Registration is
not necessary and there is no need to place a copy of the
information on deposit. There are no federal trade secrecy
laws. Each state is free to enact its own trade secrecy
laws. Trade secret laws may not govern areas that can be
covered by federal (copyright or patent) laws. When
secrecy is lost, trade secret protection is lost. There is
no protection against independent creation.

All forms of software may be a trade secret. Secrecy
of software can be maintained by distributing only object
code, requiring confidentiality agreements from all who
have access to any part of the trade secret information,
and requiring all licensees to sign an agreement
prohibiting disassembly and decompilation. Trade secrets
can be used with other forms of protection to protect items
(i.e., ideas, mathematical algorithms) not protected by
other forms of protection.

As the cases indicate, the courts have not considered
detailed technical aspects of programs in evaluating patent
applications or when determining infringement. In many
copyright infringement cases, copying was not disputed.
When the court did compare software programs, it examined
only external features such as screen formats, sequences of
sub-menus, and input data items. These methods will not be

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adequate to determine substantial similarity when the program is not distinguishable by its external features. None of the patent cases required comparison of software products. The court only needed to compare the software against the patent requirements. The court successfully found obviousness in one case (Johnston) while missing it in two cases (Bradley and Pardo). In the trade secret cases the courts evaluated the actions of humans rather than the information claimed to be a trade secret. The requirements for a trade secret (secrecy and competitive advantage) do not require a detailed understanding of the information considered to be the trade secret.

The legal protection of a software work is not simply a matter of choosing a method of protection. Chapter V explains how different methods may be used for a common software product. None of the methods appear to satisfy the needs of the software developer/distributor. Policy guidance from Congress, similar to the Semiconductor Chip Protection Act, is needed for software.

The Air Force is prohibited by statute (17 U.S.C. section 105) from obtaining copyrights for its works and it cannot satisfy the competitive advantage requirement necessary for trade secret protection. The Air Force can patent its software but not all software qualifies for patent protection. Air Force developed software that does not qualify for patent protection should be published to

ensure that it is known to be in the public domain. This will prevent contractors from claiming copyright or trade secret protection for copies or independently created identical software. The Federal Acquisition Regulations specify the rights that must be granted to the Air Force when commercially developed software is procured. Although the procurement office may waive some of these rights, it appears to be in the Air Force's best interests to strictly require that it be granted all rights to the software it procures.

Air Force working level agencies that are responsible for determining software requirements must ensure compliance with software protection laws. They must validate that procured software is not in the public domain and is not owned by the Air Force. These agencies must also ensure that procured software is maintained and used in accordance with the procurement contract and that any Air Force developed modifications do not infringe on any copyright or patent rights.

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Appendix A

Apple Computer, Inc. v. Franklin Computer Corporation,
714 F.2d 1240 (3d Cir. 1983).

mitted error in applying the law. *Kennecott Corp. v. Smith*, 637 F.2d 181, 187 (3d Cir.1980). As the Second Circuit has stated recently, "Despite oft repeated statements that the issuance of a preliminary injunction rests in the discretion of the trial judge whose decisions will be reversed only for 'abuse', a court of appeals must reverse if the district court has proceeded on the basis of an erroneous view of the applicable law." *Donovan v. Bierwirth*, 680 F.2d 263, 269 (2d Cir.), *cert. denied*, —— U.S. ——, 103 S.Ct. 488, 74 L.Ed.2d 631 (1982).

In this case the district court denied the preliminary injunction, *inter alia*, because it had "some doubt as to the copyrightability of the programs." *Apple Computer, Inc. v. Franklin Computer Corp.*, 545 F.Supp. 812, 812 (E.D.Pa.1982). This legal ruling is fundamental to all future proceedings in this action and, as the parties and amici curiae seem to agree, has considerable significance to the computer services industry.[1] Because we conclude that the district court proceeded under an erroneous view of the applicable law, we reverse the denial of the preliminary injunction and remand.

OPINION OF THE COURT

SLOVITER, Circuit Judge.

I.

INTRODUCTION

Apple Computer, Inc. appeals from the district court's denial of a motion to preliminarily enjoin Franklin Computer Corp. from infringing the copyrights Apple holds on fourteen computer programs.

The decision to grant or refuse to grant a preliminary injunction is within the discretion of the district court. *See A.O. Smith Corp. v. FTC*, 530 F.2d 515, 525 (3d Cir.1976). Although the scope of our review of the action of the district court in ruling on a motion for preliminary injunction is narrow, reversal is warranted if the trial court has abused its discretion or committed

II.

FACTS AND PROCEDURAL HISTORY

Apple, one of the computer industry leaders, manufactures and markets personal computers (microcomputers), related peripheral equipment such as disk drives (peripherals), and computer programs (software). It presently manufactures Apple II computers and distributes over 150 programs. Apple has sold over 400,000 Apple II computers, employs approximately 3,000 people, and had annual sales of $335,000,000 for fiscal year 1981. One of the byproducts of Apple's success is the independent development by third parties of numerous computer programs which are designed to run on the Apple II computer.

1. Four amicus curiae briefs have been submitted; briefs from Digital Research Inc., Microsoft Corp., and Association of Data Processing Service Organizations, Inc. (a trade association for the computer services industry), support the position of Apple, and a brief from Pro-log Corp. supports at least part of Franklin's position.

Franklin, the defendant below, manufactures and sells the ACE 100 personal computer and at the time of the hearing employed about 75 people and had sold fewer than 1,000 computers. The ACE 100 was designed to be "Apple compatible," so that peripheral equipment and software developed for use with the Apple II computer could be used in conjunction with the ACE 100. Franklin's copying of Apple's operating system computer programs in an effort to achieve such compatibility precipitated this suit.

Like all computers both the Apple II and ACE 100 have a central processing unit (CPU) which is the integrated circuit that executes programs. In lay terms, the CPU does the work it is instructed to do. Those instructions are contained on computer programs.

There are three levels of computer language in which computer programs may be written.[2] High level language, such as the commonly used BASIC or FORTRAN, uses English words and symbols, and is relatively easy to learn and understand (e.g., "GO TO 40" tells the computer to skip intervening steps and go to the step at line 40). A somewhat lower level language is assembly language, which consists of alphanumeric labels (e.g., "ADC" means "add with carry"). Statements in high level language, and apparently also statements in assembly language, are referred to as written in "source code." The third, or lowest level computer language, is machine language, a binary language using two symbols, 0 and 1, to indicate an open or closed switch (e.g., "01101001" means, to the Apple, add two numbers and save the result). Statements in machine language are referred to as written in "object code."

The CPU can only follow instructions written in object code. However, programs are usually written in source code which is more intelligible to humans. Programs written in source code can be converted or translated by a "compiler" program into object code for use by the computer. Programs are generally distributed only in their object code version stored on a memory device.

A computer program can be stored or fixed on a variety of memory devices, two of which are of particular relevance for this case. The ROM (Read Only Memory) is an internal permanent memory device consisting of a semi-conductor "chip" which is incorporated into the circuitry of the computer. A program in object code is embedded on a ROM before it is incorporated in the computer. Information stored on a ROM can only be read, not erased or rewritten.[3] The ACE 100 apparently contains EPROMS (Erasable Programmable Read Only Memory) on which the stored information can be erased and the chip reprogrammed, but the district court found that for purposes of this proceeding, the difference between ROMs and EPROMs is inconsequential. 545 F.Supp. at 813 n. 3. The other device used for storing the programs at issue is a diskette or "floppy disk", an auxiliary memory device consisting of a flexible magnetic disk resembling a phonograph record, which can be inserted into the computer and from which data or instructions can be read.

Computer programs can be categorized by function as either application programs or operating system programs. Application programs usually perform a specific task for the computer user, such as word processing, checkbook balancing, or playing a game. In contrast, operating system programs generally manage the internal functions of the computer or facilitate use of application programs. The parties agree that the fourteen computer programs at

2. Useful nontechnical descriptions of computer operations appear in Note, *Copyright Protection for Computer Programs In Read Only Memory Chips*, 11 Hofstra L.Rev. 329 (1982), and Note, *Copyright Protection of Computer Program Object Code*, 96 Harv.L.Rev. 1723 (1983).

3. In contrast to the permanent memory devices a RAM (Random Access Memory) is a chip on which volatile internal memory is stored which is erased when the computer's power is turned off.

issue in this suit are operating system programs.[4]

Apple filed suit in the United States District Court for the Eastern District of Pennsylvania pursuant to 28 U.S.C. § 1338 on May 12, 1982, alleging that Franklin was liable for copyright infringement of the fourteen computer programs, patent infringement, unfair competition, and misappropriation. Franklin's answer in respect to the copyright counts included the affirm-

ative defense that the programs contained no copyrightable subject matter. Franklin counterclaimed for declaratory judgment that the copyright registrations were invalid and unenforceable, and sought affirmative relief on the basis of Apple's alleged misuse. Franklin also moved to dismiss eleven of the fourteen copyright infringement counts on the ground that Apple failed to comply with the procedural requirements for suit under 17 U.S.C. §§ 410, 411.

4. The fourteen programs at issue, briefly described, are:

(1) *Autostart ROM* is sold as part of the Apple Computer and is embedded on a ROM chip. The program has also been published in source code as part of a copyrighted book, the Apple II manual. When the computer's power is turned on, Autostart ROM performs internal routines that turn on the circuits in the computer and make its physical parts (e.g. input/output devices, screen, and memory) ready for use.

(2) *Applesoft* is Apple's version of the Beginner's All-purpose Symbolic Instruction Code (BASIC) language. The program is stored in ROM and is sold as part of the computer. Applesoft translates instructions written in the higher-level BASIC language into the lower-level machine code that the computer understands.

(3) *Floating-Point BASIC* is the same program as Applesoft but is stored on disks rather than on ROMs. It is used in earlier versions of the Apple II computer that did not have the Applesoft program in ROM.

(4) *Apple Integer BASIC*, another translator program, is stored on the DOS 3.3 Master Disk. This program used Apple's first version of BASIC for the Apple II computer. It implements a simpler version of the Applesoft program.

(5) *DOS 3.3*, the disk operating system program, provides the instructions necessary to control the operation between the disk system (disk drive) and the computer itself. It controls the reading and writing functions of the disks and includes other routines which put all the data transfers in sequence. The DOS 3.3 Master Disk is sold separately from the computer, and includes several of the other operating programs referred to in this note.

(6) *Master Create* is stored on a disk. When a disk is prepared for use the DOS 3.3 program is placed on that disk in a form that is dependent on the amount of Random Access Memory (RAM) available. The Master Create program replaces the DOS 3.3 on the disk with a version that is independent of the amount of RAM available.

(7) *Copy*, which is stored on a disk, enables the user to copy programs written in Apple Integer BASIC from one disk to another.

(8) *Copy A*, also stored on a disk, enables the user to copy programs written in Applesoft from one disk to another.

(9) *Copy OBJO* contains a file of subroutines used by the Copy and Copy A programs.

(10) *Chain*, another disk stored program, allows data to be passed between different parts of a program when only one part of the program is in RAM at a given time. Thus, Chain preserves data already stored in RAM while another part of the program is being loaded into RAM.

(11) *Hello*, also disk stored, is the first program executed after the power is turned on and a disk is ready for use. It determines how much RAM is in the computer and which version of BASIC needs to be loaded into the computer.

(12) *Boot 13* is stored on disk and sold on a Master Disk. It allows the user having a disk controller card that contains the Apple 16-Sector Boot ROM to use older versions of the Apple disk operating system.

(13) *Apple 13-Sector Boot ROM* is stored in a ROM located on the disk controller card plugged into the Mother Board. By turning on numerous circuits on the card and in the Apple II computer, this program causes other parts of the disk operating system used for 13-Sector format disks to load.

(14) *Apple 16-Sector Boot ROM*, stored in a ROM located on the disk controller card, turns on numerous circuits on the card and in the Apple II computer and causes other parts of the disk operating system used for 16-Sector format disks to load. It therefore enables the user to start or permit the running of another program or to prepare the computer to receive a program.

The above descriptions represent an effort to translate the language used by computer experts into language reasonably intelligible to lay persons. They differ in some respects from the descriptions in the district court's opinion, 545 F.Supp. at 815–16, which were taken from the complaint.

After expedited discovery, Apple moved for a preliminary injunction to restrain Franklin from using, copying, selling, or infringing Apple's copyrights. The district court held a three day evidentiary hearing limited to the copyright infringement claims. Apple produced evidence at the hearing in the form of affidavits and testimony that programs sold by Franklin in conjunction with its ACE 100 computer were virtually identical with those covered by the fourteen Apple copyrights. The variations that did exist were minor, consisting merely of such things as deletion of reference to Apple or its copyright notice.[5] James Huston, an Apple systems programmer, concluded that the Franklin programs were "unquestionably copied from Apple and could not have been independently created." He reached this conclusion not only because it is "almost impossible for so many lines of code" to be identically written, but also because his name, which he had embedded in one program (Master Create), and the word "Applesoft", which was embedded in another (DOS 3.3), appeared on the Franklin master disk. Apple estimated the "works in suit" took 46 man-months to produce at a cost of over $740,000, not including the time or cost of creating or acquiring earlier versions of the programs or the expense of marketing the programs.

Franklin did not dispute that it copied the Apple programs. Its witness admitted copying each of the works in suit from the Apple programs. Its factual defense was directed to its contention that it was not feasible for Franklin to write its own operating system programs. David McWherter, now Franklin's vice-president of engineering, testified he spent 30–40 hours in November 1981 making a study to determine if it was feasible for Franklin to write its own Autostart ROM program and concluded it was not because "there were just too many entry points in relationship to the number of instructions in the program." Entry points at specific locations in the

program can be used by programmers to mesh their application programs with the operating system program. McWherter concluded that use of the identical signals was necessary in order to ensure 100% compatibility with application programs created to run on the Apple computer. He admitted that he never attempted to rewrite Autostart ROM and conceded that some of the works in suit (i.e. Copy, Copy A, Master Create, and Hello) probably could have been rewritten by Franklin. Franklin made no attempt to rewrite any of the programs prior to the lawsuit except for Copy, although McWherter testified that Franklin was "in the process of redesigning" some of the Apple programs and that "[w]e had a fair degree of certainty that that would probably work." Apple introduced evidence that Franklin could have rewritten programs, including the Autostart ROM program, and that there are in existence operating programs written by third parties which are compatible with Apple II.

Franklin's principal defense at the preliminary injunction hearing and before us is primarily a legal one, directed to its contention that the Apple operating system programs are not capable of copyright protection.

The district court denied the motion for preliminary injunction by order and opinion dated July 30, 1982. Apple moved for reconsideration in light of this court's decision in *Williams Electronics, Inc. v. Artic International, Inc.*, 685 F.2d 870 (3d Cir.1982), which was decided August 2, 1982, three days after the district court decision. The district court denied the motion for reconsideration. We have jurisdiction of Apple's appeal pursuant to 28 U.S.C. § 1292(a)(1).

III.

THE DISTRICT COURT OPINION

In its opinion, the district court referred to the four factors to be considered on

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5. For example, 8 bytes of memory were altered in the Autostart ROM program so that when the computer is turned on "ACE 100" appears on the screen rather than "Apple II." The

Franklin DOS 3.3 program also had 16 bytes (out of 9000) that allowed use of upper and lower case.

request for a preliminary injunction: a reasonable probability of success on the merits; irreparable injury; the improbability of harm to other interested persons; and the public interest. 545 F.Supp. at 825; *see Delaware River Port Authority v. Transamerican Trailer Transport, Inc.,* 501 F.2d 917, 919-20 (3d Cir.1974). The court stated it based its denial of the motion on the first two factors. The court held Apple had not made the requisite showing of likelihood of success on the merits because it "concluded that there is some doubt as to the copyrightability of the programs described in this litigation." 545 F.Supp. at 812. It also stated that "Apple is better suited to withstand whatever injury it might sustain during litigation than is Franklin to withstand the effects of a preliminary injunction" because an injunction would have a "devastating effect" on Franklin's business, *id.* at 825, apparently concluding on that basis that Apple had failed to show irreparable harm.

It is difficult to discern precisely why the district court questioned the copyrightability of the programs at issue since there is no finding, statement, or holding on which we can focus which clearly sets forth the district court's view. Throughout the opinion the district court referred to the "complexity of the question presented by the present case", 545 F.Supp. at 824, and the "baffling" problem at issue. *Id.* at 822.

The opinion expresses a series of generalized concerns which may have led the court to its ultimate conclusion, and which the parties and amici treat as holdings. The district court referred to the requirement under the Copyright Act of finding "original works of authorship", 17 U.S.C. § 102(a), and seems to have found that there was a sufficient "modicum of creativity" to satisfy the statutory requirement of an "original work". 545 F.Supp. at 820-21. The court was less clear as to whether the creation of a computer program by a programmer satisfied the requirement of "works of authorship", *id.*, and whether an operating system program in "binary code or one represented either in a ROM or by micro-switches" was an "expression" which could be copyrighted as distinguished from an "idea" which could not be. *Id.* at 821.

Again, although we cannot point to a specific holding, running throughout the district court opinion is the suggestion that programs in object code and ROMs may not be copyrightable. Thus, for example, in a series of discursive footnotes, the district court stated that it found "persuasive" a district court opinion "holding that object code in ROM is not copyright protected", 545 F.Supp. at 818 n. 8 (referring to *Data Cash Systems, Inc. v. JS & A Group, Inc.,* 480 F.Supp. 1063 (N.D.Ill.1979), *aff'd on other grounds,* 628 F.2d 1038 (7th Cir.1980)); described an opinion reaching a contrary conclusion as containing "rather terse analysis [which] provides little guidance", 545 F.Supp. at 818 n. 8 (referring to *GCA Corp. v. Chance,* 217 U.S.P.Q. 718 (N.D.Cal.1982), which followed the reasoning of *Tandy Corp. v. Personal Micro Computers, Inc.,* 524 F.Supp. 171 (N.D.Cal.1981)), and stated that "Congressional intent regarding the copyrightability of object codes and ROMs is not clear", 545 F.Supp. at 819, n. 9, and that even among members of the industry it was not clear that the copyright law protects works "like those in suit that are ROM-based," *id.* at 819 n. 10.

We read the district court opinion as presenting the following legal issues: (1) whether copyright can exist in a computer program expressed in object code, (2) whether copyright can exist in a computer program embedded on a ROM, (3) whether copyright can exist in an operating system program, and (4) whether independent irreparable harm must be shown for a preliminary injunction in copyright infringement actions.

IV.

DISCUSSION

A.

Copyrightability of a Computer Program Expressed in Object Code

Certain statements by the district court suggest that programs expressed in object

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code, as distinguished from source code, may not be the proper subject of copyright. We find no basis in the statute for any such concern. Furthermore, our decision in *Williams Electronics, Inc. v. Artic International, Inc., supra*, laid to rest many of the doubts expressed by the district court.

In 1976, after considerable study, Congress enacted a new copyright law to replace that which had governed since 1909. Act of October 19, 1976, Pub.L. No. 94–553, 90 Stat. 2541 (*codified at* 17 U.S.C. §§ 101 *et seq.*). Under the law, two primary requirements must be satisfied in order for a work to constitute copyrightable subject matter—it must be an "original wor[k] of authorship" and must be "fixed in [a] tangible medium of expression." 17 U.S.C. § 102(a). The statute provides:

> (a) Copyright protection subsists, in accordance with this title, in original works of authorship fixed in any tangible medium of expression, now known or later developed, from which they can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device.

Id. The statute enumerates seven categories under "works of authorship" including "literary works", defined as follows:

> "Literary works" are works, other than audiovisual works, expressed in words, numbers, or other verbal or numerical symbols or indicia, regardless of the nature of the material objects, such as books, periodicals, manuscripts, phonorecords, film, tapes, disks, or cards, in which they are embodied.

17 U.S.C. § 101. A work is "fixed" in a tangible medium of expression when:

> its embodiment in a copy or phonorecord, by or under the authority of the author, is sufficiently permanent or stable to permit it to be perceived, reproduced, or otherwise communicated for a period of more than transitory duration. A work consisting of sounds, images, or both, that are being transmitted, is "fixed" for pur-

poses of this title if a fixation of the work is being made simultaneously with its transmission.

Id.

Although section 102(a) does not expressly list computer programs as works of authorship, the legislative history suggests that programs were considered copyrightable as literary works. *See* H.R.Rep. No. 1476, 94th Cong., 2d Sess. 54, *reprinted in* 1976 U.S.Code Cong. & Ad.News 5659, 5667 ("'literary works' ... includes ... computer programs"). Because a Commission on New Technological Uses ("CONTU") had been created by Congress to study, *inter alia*, computer uses of copyrighted works, Pub.L. No. 93–573, § 201, 88 Stat. 1873 (1974), Congress enacted a status quo provision, section 117, in the 1976 Act concerning such computer uses pending the CONTU report and recommendations.[6]

The CONTU Final Report recommended that the copyright law be amended, *inter alia*, "to make it explicit that computer programs, to the extent that they embody an author's original creation, are proper subject matter of copyright." National Commission on New Technological Uses of Copyrighted Works, *Final Report* 1 (1979) [hereinafter CONTU Report]. CONTU recommended two changes relevant here: that section 117, the status quo provision, be repealed and replaced with a section limiting exclusive rights in computer programs so as "to ensure that rightful possessors of copies of computer programs may use or adapt these copies for their use," *id.;* and that a definition of computer program be added to section 101. *Id.* at 12. Congress adopted both changes. Act of Dec. 12, 1980, Pub.L. No. 96–517, § 10, 94 Stat. 3015, 3028. The revisions embodied CONTU's recommendations to clarify the law of copyright of computer software. H.R.Rep. No. 1307, 96th Cong., 2d Sess. 23, *reprinted in* 1980 U.S.Code Cong. & Ad.News 6460, 6482.

The 1980 amendments added a definition of a computer program:

6. Section 117 applied only to the scope of protection to be accorded copyrighted works when used in conjunction with a computer and not to

the copyrightability of programs. H.R.Rep. No. 1476, at 116, *reprinted in* 1976 U.S.Code Cong. & Ad.News at 5731.

A "computer program" is a set of statements or instructions to be used directly or indirectly in a computer in order to bring about a certain result.

17 U.S.C. § 101. The amendments also substituted a new section 117 which provides that "it is not an infringement for the owner of a copy of a computer program to make or authorize the making of another copy or adaptation of that computer program" when necessary to "the utilization of the computer program" or "for archival purposes only." 17 U.S.C. § 117. The parties agree that this section is not implicated in the instant lawsuit. The language of the provision, however, by carving out an exception to the normal proscriptions against copying, clearly indicates that programs are copyrightable and are otherwise afforded copyright protection.

We considered the issue of copyright protection for a computer program in *Williams Electronics, Inc. v. Artic International, Inc.*, and concluded that "the copyrightability of computer programs is firmly established after the 1980 amendment to the Copyright Act." 685 F.2d at 875. At issue in *Williams* were not only two audiovisual copyrights to the "attract" and "play" modes of a video game, but also the computer program which was expressed in object code embodied in ROM and which controlled the sights and sounds of the game. Defendant there had argued "that when the issue is the copyright on a computer program, a distinction must be drawn between the 'source code' version of a computer program, which ... can be afforded copyright protection, and the 'object code' stage, which ... cannot be so protected," an argument we rejected. *Id.* at 876.

The district court here questioned whether copyright was to be limited to works "designed to be 'read' by a human reader [as distinguished from] read by an expert with a microscope and patience", 545 F.Supp. at 821. The suggestion that copyrightability depends on a communicative function to individuals stems from the early decision of *White-Smith Music Publishing Co. v. Apollo Co.*, 209 U.S. 1, 28 S.Ct. 319, 52

L.Ed. 655 (1908), which held a piano roll was not a copy of the musical composition because it was not in a form others, except perhaps for a very expert few, could perceive. *See* 1 *Nimmer on Copyright* § 2.03[B][1] (1983). However, it is clear from the language of the 1976 Act and its legislative history that it was intended to obliterate distinctions engendered by *White-Smith*. H.R.Rep. No. 1476, *supra*, at 52, *reprinted in* 1976 U.S.Code Cong. & Ad. News at 5665.

Under the statute, copyright extends to works in any tangible means of expression "*from which they can be perceived*, reproduced, or otherwise communicated, either directly or *with the aid of a machine or device.*" 17 U.S.C. § 102(a) (emphasis added). Further, the definition of "computer program" adopted by Congress in the 1980 amendments is "sets of statements or instructions to be used *directly or indirectly* in a computer in order to bring about a certain result." 17 U.S.C. § 101 (emphasis added). As source code instructions must be translated into object code before the computer can act upon them, only instructions expressed in object code can be used "directly" by the computer. *See Midway Manufacturing Co. v. Strohon*, 564 F.Supp. 741 at 750–751 (N.D.Ill.1983). This definition was adopted following the CONTU Report in which the majority clearly took the position that object codes are proper subjects of copyright. *See* CONTU Report at 21. The majority's conclusion was reached although confronted by a dissent based upon the theory that the "machine-control phase" of a program is not directed at a human audience. *See* CONTU Report at 28–30 (dissent of Commissioner Hersey).

The defendant in *Williams* had also argued that a copyrightable work "must be intelligible to human beings and must be intended as a medium of communication to human beings," *id.* at 876–77. We reiterate the statement we made in *Williams* when we rejected that argument: "[t]he answer to defendant's contention is in the words of the statute itself." 685 F.2d at 877.

The district court also expressed uncertainty as to whether a computer program in object code could be classified as a "literary work."[7] However, the category of "literary works", one of the seven copyrightable categories, is not confined to literature in the nature of Hemingway's *For Whom the Bell Tolls*. The definition of "literary works" in section 101 includes expression not only in words but also "numbers, or other ... numerical symbols or indicia", thereby expanding the common usage of "literary works." *Cf. Harcourt, Brace & World, Inc. v. Graphic Controls Corp.*, 329 F.Supp. 517, 523-24 (S.D.N.Y. 1971) (the symbols designating questions or response spaces on exam answer sheets held to be copyrightable "writings" under 1909 Act); *Reiss v. National Quotation Bureau, Inc.*, 276 F. 717 (S.D.N.Y.1921) (code book of coined words designed for cable use copyrightable). Thus a computer program, whether in object code or source code, is a "literary work" and is protected from unauthorized copying, whether from its object or source code version. *Accord Midway Mfg. Co. v. Strohon*, 564 F.Supp. at 750-751; *see also GCA Corp. v. Chance*, 217 U.S.P.Q. at 719-20.

B.

Copyrightability of a Computer Program Embedded on a ROM

Just as the district court's suggestion of a distinction between source code and object code was rejected by our opinion in *Williams* issued three days after the district court opinion, so also was its suggestion that embodiment of a computer program on a ROM, as distinguished from in a traditional writing, detracts from its copyrightability. In *Williams* we rejected the argument that "a computer program is not infringed when the program is loaded into

electronic memory devices (ROMs) and used to control the activity of machines." 685 F.2d at 876. Defendant there had argued that there can be no copyright protection for the ROMs because they are utilitarian objects or machine parts. We held that the statutory requirement of "fixation", the manner in which the issue arises, is satisfied through the embodiment of the expression in the ROM devices. *Id.* at 874, 876; *see also Midway Mfg. Co. v. Strohon*, 564 F.Supp. at 751-752; *Tandy Corp. v. Personal Micro Computers, Inc.*, 524 F.Supp. at 173; *cf. Stern Electronics, Inc. v. Kaufman*, 669 F.2d 852, 855-56 (2d Cir.1982) (audiovisual display of video game "fixed" in ROM). Therefore we reaffirm that a computer program in object code embedded in a ROM chip is an appropriate subject of copyright. *See also* Note, *Copyright Protection of Computer Program Object Code*, 96 Harv.L. Rev. 1723 (1983); Note, *Copyright Protection for Computer Programs in Read Only Memory Chips*, 11 Hofstra L.Rev. 329 (1982).

C.

Copyrightability of Computer Operating System Programs

We turn to the heart of Franklin's position on appeal which is that computer operating system programs, as distinguished from application programs, are not the proper subject of copyright "regardless of the language or medium in which they are fixed." Brief of Appellee at 15 (emphasis deleted). Apple suggests that this issue too is foreclosed by our *Williams* decision because some portion of the program at issue there was in effect an operating system program. Franklin is correct that this was not an issue raised by the parties in *Williams* and it was not considered by the

7. The district court stated that a programmer working directly in object code appears to think more as a mathematician or engineer, that the process of constructing a chip is less a work of authorship than the product of engineering knowledge, and that it may be more apt to describe an encoded ROM as a pictorial three-dimensional object than as a literary

work 545 F.Supp at 821-22. The district court's remarks relied in part on a quotation about "microcode", *see id.* at 821 n. 14; Apple introduced testimony that none of the works in suit contain "microcode." Moreover, Apple does not seek to protect the ROM's architecture but only the program encoded upon it.

court. Thus we consider it as a matter of first impression.

Franklin contends that operating system programs are *per se* excluded from copyright protection under the express terms of section 102(b) of the Copyright Act, and under the precedent and underlying principles of *Baker v. Selden*, 101 U.S. 99, 25 L.Ed. 841 (1879). These separate grounds have substantial analytic overlap.

In *Baker v. Selden*, plaintiff's testator held a copyright on a book explaining a bookkeeping system which included blank forms with ruled lines and headings designed for use with that system. Plaintiff sued for copyright infringement on the basis of defendant's publication of a book containing a different arrangement of the columns and different headings, but which used a similar plan so far as results were concerned. The Court, in reversing the decree for the plaintiff, concluded that blank account-books were not the subject of copyright and that "the mere copyright of Selden's book did not confer upon him the exclusive right to make and use account-books, ruled and arranged as designated by him and described and illustrated in said book." *Id.* at 107. The Court stated that copyright of the books did not give the plaintiff the exclusive right to use the system explained in the books, noting, for example, that "copyright of a work on mathematical science cannot give to the author an exclusive right to the methods of operation which he propounds." *Id.* at 103.

Franklin reads *Baker v. Selden* as "stand[ing] for several fundamental principles, each presenting . . . an insuperable obstacle to the copyrightability of Apple's operating systems." It states:

First, *Baker* teaches that use of a system itself does not infringe a copyright on the

description of the system. *Second, Baker* enunciates the rule that copyright does not extend to purely utilitarian works. *Finally, Baker* emphasizes that the copyright laws may not be used to obtain and hold a monopoly over an idea. In so doing, *Baker* highlights the principal difference between the copyright and patent laws—a difference that is highly pertinent in this case.

Brief of Appellee at 22.

Section 102(b) of the Copyright Act, the other ground on which Franklin relies, appeared first in the 1976 version, long after the decision in *Baker v. Selden*. It provides:

In no case does copyright protection for an original work of authorship extend to any idea, procedure, process, system, method of operation, concept, principle, or discovery, regardless of the form in which it is described, explained, illustrated, or embodied in such work.

It is apparent that section 102(b) codifies a substantial part of the holding and dictum of *Baker v. Selden. See* 1 *Nimmer on Copyright* § 2.18[D], at 2–207.

We turn to consider the two principal points of Franklin's argument.

1. *"Process", "System" or "Method of Operation"*

Franklin argues that an operating system program is either a "process", "system", or "method of operation" and hence uncopyrightable.[8] Franklin correctly notes that underlying section 102(b) and many of the statements for which *Baker v. Selden* is cited is the distinction which must be made between property subject to the patent law, which protects discoveries, and that subject to copyright law, which protects the writings describing such discoveries. However,

8. We are unpersuaded by Franklin's initial contention that Apple is bound to this position because some of Apple's witnesses in the preliminary injunction hearing used these terms in describing the works in suit. As the CONTU Report itself recognized, the distinction between copyrightable computer programs and uncopyrightable processes or methods of operation does not always seem to "shimmer with

clarity." CONTU Report at 18. The witnesses undoubtedly had the not uncommon difficulty of finding the precisely correct words of description in this field. It would be both unreasonable and arbitrary to consider the statements of non-lawyer witnesses without experience in using statutory language as words of art to be binding admissions against Apple.

Franklin's argument misapplies that distinction in this case. Apple does not seek to copyright the method which instructs the computer to perform its operating functions but only the instructions themselves. The method would be protected, if at all, by the patent law, an issue as yet unresolved. See Diamond v. Diehr, 450 U.S. 175, 101 S.Ct. 1048, 67 L.Ed.2d 155 (1981).

Franklin's attack on operating system programs as "methods" or "processes" seems inconsistent with its concession that application programs are an appropriate subject of copyright. Both types of programs instruct the computer to do something. Therefore, it should make no difference for purposes of section 102(b) whether these instructions tell the computer to help prepare an income tax return (the task of an application program) or to translate a high level language program from source code into its binary language object code form (the task of an operating system program such as "Applesoft", see note 4 supra). Since it is only the instructions which are protected, a "process" is no more involved because the instructions in an operating system program may be used to activate the operation of the computer than it would be if instructions were written in ordinary English in a manual which described the necessary steps to activate an intricate complicated machine. There is, therefore, no reason to afford any less copyright protection to the instructions in an operating system program than to the instructions in an application program.

Franklin's argument, receptively treated by the district court, that an operating system program is part of a machine mistakenly focuses on the physical characteristics of the instructions. But the medium is not the message. We have already considered and rejected aspects of this contention in the discussion of object code and ROM. The mere fact that the operating system program may be etched on a ROM does not make the program either a machine, part of a machine or its equivalent. Furthermore, as one of Franklin's witnesses testified, an operating system does not have to be per-

manently in the machine in ROM, but it may be on some other medium, such as a diskette or magnetic tape, where it could be readily transferred into the temporary memory space of the computer. In fact, some of the operating systems at issue were on diskette. As the CONTU majority stated,

Programs should no more be considered machine parts than videotapes should be considered parts of projectors or phonorecords parts of sound reproduction equipment.... That the words of a program are used ultimately in the implementation of a process should in no way affect their copyrightability.

CONTU Report at 21.

Franklin also argues that the operating systems cannot be copyrighted because they are "purely utilitarian works" and that Apple is seeking to block the use of the art embodied in its operating systems. This argument stems from the following dictum in Baker v. Selden:

The very object of publishing a book on science or the useful arts is to communicate to the world the useful knowledge which it contains. But this object would be frustrated if the knowledge could not be used without incurring the guilt of piracy of the book. And where the art it teaches cannot be used without employing the methods and diagrams used to illustrate the book, or such as are similar to them, such methods and diagrams are to be considered as necessary incidents to the art, and given therewith to the public; not given for the purpose of publication in other works explanatory of the art, but for the purpose of practical application.

101 U.S. at 103. We cannot accept the expansive reading given to this language by some courts, see, e.g., Taylor Instrument Companies v. Fawley-Brost Co., 139 F.2d 98 (7th Cir.1943), cert. denied, 321 U.S. 785, 64 S.Ct. 782, 88 L.Ed. 1076 (1944). In this respect we agree with the views expressed by Professor Nimmer in his treatise. See 1 Nimmer on Copyright § 2.18[C].

Although a literal construction of this language could support Franklin's reading that precludes copyrightability if the copyright work is put to a utilitarian use, that interpretation has been rejected by a later Supreme Court decision. In *Mazer v. Stein*, 347 U.S. 201, 218, 74 S.Ct. 460, 471, 98 L.Ed. 630 (1954), the Court stated: "We find nothing in the copyright statute to support the argument that the intended use or use in industry of an article eligible for copyright bars or invalidates its registration. We do not read such a limitation into the copyright law." *Id.* at 218, 74 S.Ct. at 471. The CONTU majority also rejected the expansive view some courts have given *Baker v. Selden*, and stated, "That the words of a program are used ultimately in the implementation of a process should in no way affect their copyrightability." *Id.* at 21. It referred to "copyright practice past and present, which recognizes copyright protection for a work of authorship regardless of the uses to which it may be put." *Id.* The Commission continued: "The copyright status of the written rules for a game *or a system for the operation of a machine* is unaffected by the fact that those rules direct the actions of those who play the game or *carry out the process*." *Id.* (emphasis added). As we previously noted, we can consider the CONTU Report as accepted by Congress since Congress wrote into the law the majority's recommendations almost verbatim. *See* 18 Cong.Rec. H10767 (daily ed. Nov. 17, 1980) (Rep. Kastenmeier: Bill "eliminates confusion about the legal status of computer software by enacting the recommendations of [CONTU] clarifying the law of copyright of computer software"); 18 Cong.Rec. S14766 (daily ed. Nov. 20, 1980) (Sen. Bayh: "[t]his language reflects that proposed by [CONTU"]).

Perhaps the most convincing item leading us to reject Franklin's argument is that the statutory definition of a computer program as a set of instructions to be used in a computer in order to bring about a certain result, 17 U.S.C. § 101, makes no distinction between application programs and operating programs. Franklin can point to no decision which adopts the distinction it

seeks to make. In the one other reported case to have considered it, *Apple Computer, Inc. v. Formula International, Inc.,* 562 F.Supp. 775 (C.D.Cal.1983), the court reached the same conclusion which we do, *i.e.* that an operating system program is not *per se* precluded from copyright. It stated, "There is nothing in any of the statutory terms which suggest a different result for different types of computer programs based upon the function they serve within the machine." *Id.* at 780. Other courts have also upheld the copyrightability of operating programs without discussion of this issue. *See Tandy Corp. v. Personal Micro Computers, Inc.,* 524 F.Supp. at 173 (input-output routine stored in ROM which translated input into machine language in a similar fashion as Applesoft and Apple Integer Basic proper subject of copyright); *GCA Corp. v. Chance,* 217 U.S.P.Q. at 719–20 (object code version of registered source code version of operating programs is the same work and protected).

2. Idea/Expression Dichotomy

Franklin's other challenge to copyright of operating system programs relies on the line which is drawn between ideas and their expression. *Baker v. Seiden* remains a benchmark in the law of copyright for the reading given it in *Mazer v. Stein, supra,* where the Court stated, "Unlike a patent, a copyright gives no exclusive right to the art disclosed; protection is given only to the expression of the idea—not the idea itself." 347 U.S. at 217, 74 S.Ct. at 470 (footnote omitted).

The expression/idea dichotomy is now expressly recognized in section 102(b) which precludes copyright for "any idea." This provision was not intended to enlarge or contract the scope of copyright protection but "to restate ... that the basic dichotomy between expression and idea remains unchanged." H.R.Rep. No. 1476, *supra,* at 57, *reprinted in* 1976 U.S.Code Cong. & Ad. News at 5670. The legislative history indicates that section 102(b) was intended "to make clear that the expression adopted by the programmer is the copyrightable ele-

ment in a computer program, and that the actual processes or methods embodied in the program are not within the scope of the copyright law." *Id.*

Many of the courts which have sought to draw the line between an idea and expression have found difficulty in articulating where it falls. *See, e.g., Nichols v. Universal Pictures Corp.*, 45 F.2d 119, 121 (2d Cir.1930) (L. Hand, J.); *see* discussion in 3 *Nimmer on Copyright* § 13.03[A]. We believe that in the context before us, a program for an operating system, the line must be a pragmatic one, which also keeps in consideration "the preservation of the balance between competition and protection reflected in the patent and copyright laws". *Herbert Rosenthal Jewelry Corp. v. Kalpakiar*, 446 F.2d 738, 742 (9th Cir.1971). As we stated in *Franklin Mint Corp. v. National Wildlife Art Exchange, Inc.*, 575 F.2d 62, 64 (3d Cir.), *cert. denied*, 439 U.S. 880, 99 S.Ct. 217, 58 L.Ed.2d 193 (1978), "Unlike a patent, a copyright protects originality rather than novelty or invention." In that opinion, we quoted approvingly the following passage from *Dymow v. Bolton*, 11 F.2d 690, 691 (2d Cir.1926):

> Just as a patent affords protection only to the means of reducing an inventive idea to practice, so the copyright law protects the means of expressing an idea; and it is as near the whole truth as generalization can usually reach that, *if the same idea can be expressed in a plurality of totally different manners, a plurality of copyrights may result, and no infringement will exist.*

(emphasis added).

We adopt the suggestion in the above language and thus focus on whether the idea is capable of various modes of expression. If other programs can be written or created which perform the same function as an Apple's operating system program, then that program is an expression of the idea and hence copyrightable. In essence, this inquiry is no different than that made to determine whether the expression and idea have merged, which has been stated to occur where there are no or

few other ways of expressing a particular idea. *See, e.g., Morrissey v. Procter & Gamble Co.*, 379 F.2d 675, 678-79 (1st Cir. 1967); *Freedman v. Grolier Enterprises, Inc.*, 179 U.S.P.Q. 476, 478 (S.D.N.Y.1973) ("[c]opyright protection will not be given to a form of expression necessarily dictated by the underlying subject matter"); CONTU Report at 20.

The district court made no findings as to whether some or all of Apple's operating programs represent the only means of expression of the idea underlying them. Although there seems to be a concession by Franklin that at least some of the programs can be rewritten, we do not believe that the record on that issue is so clear that it can be decided at the appellate level. Therefore, if the issue is pressed on remand, the necessary finding can be made at that time.

Franklin claims that whether or not the programs can be rewritten, there are a limited "number of ways to arrange operating systems to enable a computer to run the vast body of Apple-compatible software", Brief of Appellee at 20. This claim has no pertinence to either the idea/expression dichotomy or merger. The idea which may merge with the expression, thus making the copyright unavailable, is the idea which is the subject of the expression. The idea of one of the operating system programs is, for example, how to translate source code into object code. If other methods of expressing that idea are not foreclosed as a practical matter, then there is no merger. Franklin may wish to achieve total compatibility with independently developed application programs written for the Apple II, but that is a commercial and competitive objective which does not enter into the somewhat metaphysical issue of whether particular ideas and expressions have merged.

In summary, Franklin's contentions that operating system programs are *per se* not copyrightable is unpersuasive. The other courts before whom this issue has been raised have rejected the distinction. Neither the CONTU majority nor Congress made a distinction between operating and application programs. We believe that the

1980 amendments reflect Congress' receptivity to new technology and its desire to encourage, through the copyright laws, continued imagination and creativity in computer programming. Since we believe that the district court's decision on the preliminary injunction was, to a large part, influenced by an erroneous view of the availability of copyright for operating system programs and unnecessary concerns about object code and ROMs, we must reverse the denial of the preliminary injunction and remand for reconsideration.

D.

Irreparable Harm

The district court, without any extended discussion, found that Apple had not made the requisite showing of irreparable harm, stating "Apple is better suited to withstand whatever injury it might sustain during litigation than is Franklin to withstand the effects of a preliminary injunction." 545 F.Supp. at 812, 825. In so ruling, the district court failed to consider the prevailing view that a showing of a prima facie case of copyright infringement or reasonable likelihood of success on the merits raises a presumption of irreparable harm. See, e.g., Atari, Inc. v. North American Philips Consumer Electronics Corp., 672 F.2d 607, 620 (7th Cir.), cert. denied, — U.S. ——, 103 S.Ct. 176, 74 L.Ed.2d 145 (1982); Wainwright Securities Inc. v. Wall Street Transcript Corp., 558 F.2d 91, 94 (2d Cir.1977), cert. denied, 434 U.S. 1014, 98 S.Ct. 730, 54 L.Ed.2d 759 (1978); Klitzner Industries, Inc. v. H.K. James & Co., 535 F.Supp. 1249, 1259 (E.D.Pa.1982); Custom Decor, Inc. v. Nautical Crafts Inc., 502 F.Supp. 154, 157 (E.D.Pa.1980). A copyright plaintiff who makes out a prima facie case of infringement is entitled to a preliminary injunction without a detailed showing of irreparable harm. See 3 Nimmer on Copyright § 14.06[A], at 14–50, 14–51 & n. 16 (collecting authorities).

The CONTU Final Report recognized that "[t]he cost of developing computer programs is far greater than the cost of their duplication." CONTU Report at 11.

Apple introduced substantial evidence of the considerable time and money it had invested in the development of the computer programs in suit. Thus even without the presumption of irreparable harm generally applied in copyright infringement cases, the jeopardy to Apple's investment and competitive position caused by Franklin's wholesale copying of many of its key operating programs would satisfy the requirement of irreparable harm needed to support a preliminary injunction. See Atari, Inc. v. North American Philips Consumer Electronics Corp., 672 F.2d at 620; Custom Decor, Inc. v. Nautical Crafts Inc., 502 F.Supp. 154, 157 (E.D.Tenn.1980); Herbert Rosenthal Jewelry Corp. v. Zale Corp., 323 F.Supp. 1234, 1238 (S.D.N.Y.1971).

In Kontes Glass Co. v. Lab Glass, Inc., 373 F.2d 319, 320–21 (3d Cir.1967), this court appeared to adopt an inverse relationship approach to the irreparable harm issue, suggesting that the strength of the required showing of irreparable injury varies inversely with the strength of plaintiff's showing of a likelihood of success on the merits. See Midway Mfg. Co. v. Bandai-America, Inc., 546 F.Supp. 125, 141–42 (D.N.J.1982). In Kontes, we were not presented with a case in which copyrighted material central to the essence of plaintiff's operations was concededly copied, as we are here. We believe the Kontes approach is best suited to those cases where the injury from copying can be fairly considered minimal, limited or conjectural. In those circumstances it provides flexibility in applying the equitable remedy of preliminary injunctions through evaluation of the irreparable harm factor. Normally, however, the public interest underlying the copyright law requires a presumption of irreparable harm, as long as there is, as here, adequate evidence of the expenditure of significant time, effort and money directed to the production of the copyrighted material. Otherwise, the rationale for protecting copyright, that of encouraging creativity, would be undermined. As Judge Broderick stated in Klitzner Industries, Inc. v. H.K. James & Co., 535 F.Supp. at 1259–60:

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Since Congress has elected to grant certain exclusive rights to the owner of a copyright in a protected work, it is virtually axiomatic that the public interest can only be served by upholding copyright protections and, correspondingly, preventing the misappropriation of the skills, creative energies, and resources which are invested in the protected work.

Nor can we accept the district court's explanation which stressed the "devastating effect" of a preliminary injunction on Franklin's business. If that were the correct standard, then a knowing infringer would be permitted to construct its business around its infringement, a result we cannot condone. *See Atari, Inc. v. North American Philips Consumer Electronics Corp.,* 672 F.2d at 620; *cf. Helene Curtis Industries, Inc. v. Church & Dwight Co.,* 560 F.2d 1325, 1333 (7th Cir.1977) (trademark infringement), *cert. denied,* 434 U.S. 1070, 98 S.Ct. 1252, 55 L.Ed.2d 772 (1978). The size of the infringer should not be determinative of the copyright holder's ability to get prompt judicial redress.

E.

Additional Issues

Franklin has raised a number of issues concerning Apple's compliance with various statutory formalities such as registration, notice and deposit. It has challenged, in a pending motion to dismiss, the copyrights of the eleven works in suit which were deposited in object code format, and which were registered under the Copyright Office's "rule of doubt."[9] Franklin challenges three programs, i.e. Apple Integer Basic, Autostart ROM and DOS 3.3, on the ground that they or their predecessors were published without the requisite notice. We do not reach these issues on appeal nor do we consider Franklin's claim that Apple's misuse of its copyrights bars their enforcement. The district court did not consider these claims in denying the motion for preliminary injunction. There are no factual

9. Apparently the Register of Copyrights utilizes its rule of doubt when the deposit of a computer program is made in object code form be-

findings with regard to them. On remand, they can be considered by the district court in the first instance who can also decide the extent to which they are relevant, if at all, to a preliminary injunction.

V.

For the reasons set forth in this opinion, we will reverse the denial of the preliminary injunction and remand to the district court for further proceedings in accordance herewith.

Appendix B

Parker v. Flook
437 U.S. 584, 98 S. Ct. 2522 (1978).

PARKER, ACTING COMMISSIONER OF PATENTS AND TRADEMARKS v. FLOOK

CERTIORARI TO THE COURT OF CUSTOMS AND PATENT APPEALS

No. 77-642. Argued April 25, 1978—Decided June 22, 1978

Respondent's method for updating alarm limits during catalytic conversion processes, in which the only novel feature is a mathematical formula, *held* not patentable under § 101 of the Patent Act. The identification of a limited category of useful, though conventional, post-solution applications of such a formula does not make the method eligible for patent protection, since assuming the formula to be within prior art, as it must be, *O'Reilly* v. *Morse*, 15 How. 62, respondent's application contains no patentable invention. The chemical processes involved in catalytic conversion are well known, as are the monitoring of process variables, the use of alarm limits to trigger alarms, the notion that alarm limit values must be recomputed and readjusted, and the use of computers for "automatic process monitoring." Pp. 588–596.

559 F. 2d 21, reversed.

Stevens, J., delivered the opinion of the Court, in which Brennan, White, Marshall, Blackmun, and Powell, JJ., joined. Stewart, J., filed a dissenting opinion, in which Burger, C. J., and Rehnquist, J., joined, *post*, p. 598.

Deputy Solicitor General Wallace argued the cause for petitioner. On the briefs were *Solicitor General McCree, Assistant Attorney General Shenefield, Richard H. Stern, Joseph F. Nakamura,* and *Jere W. Sears.*

D. Dennis Allegretti argued the cause for respondent. With him on the brief were *Charles G. Call, Edward W. Remus,* and *Frank J. Uxa, Jr.**

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*John S. Voorhees and *Kenneth E. Krosin* filed a brief for the Computer Business Equipment Manufacturers Assn. as *amicus curiae* urging reversal.

Briefs of *amici curiae* urging affirmance were filed by *Carol A. Cohen* for Applied Data Research, Inc.; and by *Morton C. Jacobs* and *David Cohen* for the Association of Data Processing Service Organizations.

Briefs of *amici curiae* were filed by *James W. Geriak* for the American

MR. JUSTICE STEVENS delivered the opinion of the Court.

Respondent applied for a patent on a "Method for Updating Alarm Limits." The only novel feature of the method is a mathematical formula. In *Gottschalk* v. *Benson,* 409 U. S. 63, we held that the discovery of a novel and useful mathematical formula may not be patented. The question in this case is whether the identification of a limited category of useful, though conventional, post-solution applications of such a formula makes respondeñt's method eligible for patent protection.

I

An "alarm limit" is a number. During catalytic conversion processes, operating conditions such as temperature, pressure, and flow rates are constantly monitored. When any of these "process variables" exceeds a predetermined "alarm limit," an alarm may signal the presence of an abnormal condition indicating either inefficiency or perhaps danger. Fixed alarm limits may be appropriate for a steady operation, but during transient operating situations, such as start-up, it may be necessary to "update" the alarm limits periodically.

Respondent's patent application describes a method of updating alarm limits. In essence, the method consists of three steps: an initial step which merely measures the present value of the process variable (*e. g.,* the temperature); an intermediate step which uses an algorithm[1] to calculate an updated alarm-limit value; and a final step in which the actual alarm limit is adjusted to the updated value.[2] The only difference

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Patent Law Assn. et al.; by *Richard E. Kurtz, Michael G. Gilman,* and *Charles A. Huggett* for Mobil Oil Corp.; and by *Reed C. Lawlor* and *Theodore H. Lassagne* for Software Associates, Inc.

[1] We use the word "algorithm" in this case, as we did in *Gottschalk* v. *Benson,* 409 U. S. 63, 65, to mean "[a] procedure for solving a given type of mathematical problem . . . ."

[2] Claim 1 of the patent is set forth in the appendix to this opinion, which also contains a more complete description of these three steps.

between the conventional methods of changing alarm limits
and that described in respondent's application rests in the sec-
ond step—the mathematical algorithm or formula. Using the
formula, an operator can calculate an updated alarm limit
once he knows the original alarm base, the appropriate margin
of saf·ty, the time interval that should elapse between each
updating, the current temperature (or other process variable),
and the appropriate weighting factor to be used to average the
original alarm base and the current temperature.

The patent application does not purport to explain how to
select the appropriate margin of safety, the weighting factor,
or any of the other variables. Nor does it purport to contain
any disclosure relating to the chemical processes at work, the
monitoring of process variables, or the means of setting off an
alarm or adjusting an alarm system. All that it provides is a
formula for computing an updated alarm limit. Although
the computations can be made by pencil and paper calcula-
tions, the abstract of disclosure makes it clear that the formula
is ·primarily useful for computerized calculations producing
automatic adjustments in alarm settings.[3]

The patent claims cover any use of respondent's formula for
updating the value of an alarm limit on any process variable
involved in a process comprising the catalytic chemical con-
version of hydrocarbons. Since there are numerous processes
of that kind in the petrochemical and oil-refining industries,[4]
the claims cover a broad range of potential uses of the method.
They do not, however, cover every conceivable application of
the formula.

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[3] App. 13A.

[4] Examples mentioned in the abstract of disclosure include naphtha
reforming, petroleum distillate and petroleum residuum cracking, hydro-
cracking and desulfurization, aromatic hydrocarbon and paraffin isomeriza-
tion and disproportionation, paraffin-olefin alkylation, and the like. *Id.*,
at 8A.

II

The patent examiner rejected the application. He found that the mathematical formula constituted the only difference between respondent's claims and the prior art and therefore a patent on this method "would in practical effect be a patent on the formula or mathematics itself."[5] The examiner concluded that the claims did not describe a discovery that was eligible for patent protection.

The Board of Appeals of the Patent and Trademark Office sustained the examiner's rejection. The Board also concluded that the "point of novelty in [respondent's] claimed method"[6] lay in the formula or algorithm described in the claims, a subject matter that was unpatentable under *Benson, supra.*

The Court of Customs and Patent Appeals reversed. *In re Flook,* 559 F. 2d 21. It read *Benson* as applying only to claims that entirely pre-empt a mathematical formula or algorithm, and noted that respondent was only claiming on the use of his method to update alarm limits in a process comprising the catalytic chemical conversion of hydrocarbons. The court reasoned that since the mere solution of the algorithm would not constitute infringement of the claims, a patent on the method would not pre-empt the formula.

The Acting Commissioner of Patents and Trademarks filed a petition for a writ of certiorari, urging that the decision of the Court of Customs and Patent Appeals will have a debilitating effect on the rapidly expanding computer "software" industry,[7] and will require him to process thousands of addi-

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[5] *Id.,* at 47A.

[6] *Id.,* at 60A.

[7] The term "software" is used in the industry to describe computer programs. The value of computer programs in use in the United States in 1976 was placed at $43.1 billion, and projected at $70.7 billion by 1980 according to one industry estimate. See Brief for the Computer & Business Equipment Manufacturers Assn. as *Amicus Curiae* 17–18, n. 16.

tional patent applications.   Because of the importance of the question, we granted certiorari, 434 U. S. 1033.

III

This case turns entirely on the proper construction of § 101 of the Patent Act, which describes the subject matter that is eligible for patent protection.[8]   It does not involve the familiar issues of novelty and obviousness that routinely arise under §§ 102 and 103 when the validity of a patent is challenged.   For the purpose of our analysis, we assume that respondent's formula is novel and useful and that he discovered it.   We also assume, since respondent does not challenge the examiner's finding, that the formula is the only novel feature of respondent's method.   The question is whether the discovery of this feature makes an otherwise conventional method eligible for patent protection.

The plain language of § 101 does not answer the question. It is true, as respondent argues, that his method is a "process" in the ordinary sense of the word.[9]   But that was also true of the algorithm, which described a method for converting binary-coded decimal numerals into pure binary numerals,

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[8] Title 35 U. S. C. § 101 provides:

"Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title."

Section 100 (b) provides:

"The term 'process' means process, art or method, and includes a new use of a known process, machine, manufacture, composition of matter, or material."

[9] The statutory definition of "process" is broad.   See n. 8, *supra*.   An argument can be made, however, that this Court has only recognized a process as within the statutory definition when it either was tied to a particular apparatus or operated to change materials to a "different state or thing."   See *Cochrane* v. *Deener*, 94 U. S. 780, 787-788.   As in *Benson*, we assume that a valid process patent may issue even if it does not meet one of these qualifications of our earlier precedents.   409 U. S., at 71.

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that was involved in *Gottschalk* v. *Benson*. The holding that
the discovery of that method could not be patented as a
"process" forecloses a purely literal reading of § 101.[10] Rea-
soning that an algorithm, or mathematical formula, is like
a law of nature, *Benson* applied the established rule that a
law of nature cannot be the subject of a patent. Quoting
from earlier cases, we said:

> " 'A principle, in the abstract, is a fundamental truth; an
> original cause; a motive; these cannot be patented, as no
> one can claim in either of them an exclusive right.' *Le
> Roy* v. *Tatham*, 14 How. 156, 175. Phenomena of nature,
> though just discovered, mental processes, and abstract
> intellectual concepts are not patentable, as they are the
> basic tools of scientific and technological work." 409
> U. S., at 67.

The line between a patentable "process" and an unpatenta-
ble "principle" is not always clear. Both are "conception[s]
of the mind, seen only by [their] effects when being executed
or performed." *Tilghman* v. *Proctor*, 102 U. S. 707, 728. In
Benson we concluded that the process application in fact
sought to patent an idea, noting that

> "[t]he mathematical formula involved here has no sub-
> stantial practical application except in connection with
> a digital computer, which means that if the judgment
> below is affirmed, the patent would wholly pre-empt the
> mathematical formula and in practical effect would be a
> patent on the algorithm itself." 409 U. S., at 71–72.

Respondent correctly points out that this language does
not apply to his claims. He does not seek to "wholly pre-
empt the mathematical formula," since there are uses of his

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[10] In *Benson* we phrased the issue in this way:
"The question is whether the method described and claimed is a
'process' within the meaning of the Patent Act." *Id.*, at 64.

formula outside the petrochemical and oil-refining industries that remain in the public domain. And he argues that the presence of specific "post-solution" activity—the adjustment of the alarm limit to the figure computed according to the formula—distinguishes this case from *Benson* and makes his process patentable. We cannot agree.

The notion that post-solution activity, no matter how conventional or obvious in itself, can transform an unpatentable principle into a patentable process exalts form over substance. A competent draftsman could attach some form of post-solution activity to almost any mathematical formula; the Pythagorean theorem would not have been patentable, or partially patentable, because a patent application contained a final step indicating that the formula, when solved, could be usefully applied to existing surveying techniques.[11] The concept of patentable subject matter under § 101 is not "like a nose of wax which may be turned and twisted in any direction . . . ." *White* v. *Dunbar*, 119 U. S. 47, 51.

Yet it is equally clear that a process is not unpatentable simply because it contains a law of nature or a mathematical algorithm. See *Eibel Process Co.* v. *Minnesota & Ontario Paper Co.*, 261 U. S. 45; *Tilghman* v. *Proctor, supra.*[12] For

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[11] It should be noted that in *Benson* there was a specific end use contemplated for the algorithm—utilization of the algorithm in computer programming. See *In re Chatfield*, 545 F. 2d 152, 161 (CCPA 1976) (Rich, J., dissenting). Of course, as the Court pointed out, the formula had no other practical application; but it is not entirely clear why a process claim is any more or less patentable because the specific end use contemplated is the only one for which the algorithm has any practical application.

[12] In *Eibel Process Co.* the Court upheld a patent on an improvement on a papermaking machine that made use of the law of gravity to enhance the flow of the product. The patentee, of course, did not claim to have discovered the force of gravity, but that force was an element in his novel conception.

Tilghman v. *Proctor* involved a process claim for " 'the manufacturing

instance, in *Mackay Radio & Telegraph Co.* v. *Radio Corp. of America,* 306 U. S. 86, the applicant sought a patent on a directional antenna system in which the wire arrangement was determined by the logical application of a mathematical formula. Putting the question of patentability to one side as a preface to his analysis of the infringement issue, Mr. Justice Stone, writing for the Court, explained:

> "While a scientific truth, or the mathematical expression of it, is not patentable invention, a novel and useful structure created with the aid of knowledge of scientific truth may be." *Id.,* at 94.

Funk Bros. Seed Co. v. *Kalo Co.,* 333 U. S. 127, 130, expresses a similar approach:

> "He who discovers a hitherto unknown phenomenon of nature has no claim to a monopoly of it which the law recognizes. If there is to be invention from such a discovery, it must come from the application of the law of nature to a new and useful end."

Mackay Radio and *Funk Bros.* point to the proper analysis for this case: The process itself, not merely the mathematical algorithm, must be new and useful. Indeed, the novelty of the mathematical algorithm is not a determining factor at all. Whether the algorithm was in fact known or unknown at the time of the claimed invention, as one of the "basic tools of scientific and technological work," see *Gottschalk* v. *Benson,*

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of fat acids and glycerine from fatty bodies.'" The Court distinguished the process from the principle involved as follows:

"[T]he claim of the patent is not for a mere principle. The chemical principle or scientific fact upon which it is founded is, that the elements of neutral fat require to be severally united with an atomic equivalent of water in order to separate from each other and become free. This chemical fact was not discovered by Tilghman. He only claims to have invented a particular mode of bringing about the desired chemical union between the fatty elements and water." 102 U. S., at 729.

409 U. S., at 67, it is treated as though it were a familiar part of the prior art.

This is also the teaching of our landmark decision in *O'Reilly* v. *Morse*, 15 How. 62. In that case the Court rejected Samuel Morse's broad claim covering any use of electromagnetism for printing intelligible signs, characters, or letters at a distance. *Id.*, at 112–121. In reviewing earlier cases applying the rule that a scientific principle cannot be patented, the Court placed particular emphasis on the English case of *Neilson* v. *Harford*, Web. Pat. Cases 295, 371 (1844), which involved the circulation of heated air in a furnace system to increase its efficiency. The English court rejected the argument that the patent merely covered the principle that furnace temperature could be increased by injecting hot air, instead of cold into the furnace. That court's explanation of its decision was relied on by this Court in *Morse:*

> " 'It is very difficult to distinguish it [the Neilson patent] from the specification of a patent for a principle, and this at first created in the minds of the court much difficulty; but after full consideration, we think that the plaintiff does not merely claim a principle, but a machine, embodying a principle, and a very valuable one. *We think the case must be considered as if the principle being well known, the plaintiff had first invented a mode of applying it . . . .'* " 15 How., at 115 (emphasis added).[13]

We think this case must also be considered as if the principle or mathematical formula were well known.

Respondent argues that this approach improperly imports into § 101 the considerations of "inventiveness" which are the proper concerns of §§ 102 and 103.[14] This argument is based on two fundamental misconceptions.

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[13] See also *Risdon Locomotive Works* v. *Medart*, 158 U. S. 68; *Tilghman* v. *Proctor, supra.*

[14] Sections 102 and 103 establish certain conditions, such as novelty and nonobviousness, to patentability.

First, respondent incorrectly assumes that if a process application implements a principle in some specific fashion, it automatically falls within the patentable subject matter of § 101 and the substantive patentability of the particular process can then be determined by the conditions of §§ 102 and 103. This assumption is based on respondent's narrow reading of *Benson,* and is as untenable in the context of § 101 as it is in the context of that case. It would make the determination of patentable subject matter depend simply on the draftsman's art and would ill serve the principles underlying the prohibition against patents for "ideas" or phenomena of nature. The rule that the discovery of a law of nature cannot be patented rests, not on the notion that natural phenomena are not processes, but rather on the more fundamental understanding that they are not the kind of "discoveries" that the statute was enacted to protect.[18] The obligation to determine what type of discovery is sought to be patented must precede the determination of whether that discovery is, in fact, new or obvious.

Second, respondent assumes that the fatal objection to his application is the fact that one of its components—the mathe-

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[18] The underlying notion is that a scientific principle, such as that expressed in respondent's algorithm, reveals a relationship that has always existed.

"An example of such a discovery [of a scientific principle] was Newton's formulation of the law of universal gravitation, relating the force of attraction between two bodies, F, to their masses, m and m', and the square of the distance, d, between their centers, according to the equation $F = mm'/d^2$. But this relationship always existed—even before Newton announced his celebrated law. Such 'mere' recognition of a theretofore existing phenomenon or relationship carries with it no rights to exclude others from its enjoyment. . . . Patentable subject matter must be new (novel); not merely heretofore unknown. There is a very compelling reason for this rule. The reason is founded upon the proposition that in granting patent rights, the public must not be deprived of any rights that it theretofore freely enjoyed." P. Rosenberg, Patent Law Fundamentals, § 4, p. 13 (1975).

matical formula—consists of unpatentable subject matter. In countering this supposed objection, respondent relies on opinions by the Court of Customs and Patent Appeals which reject the notion "that a claim may be dissected, the claim components searched in the prior art, and, if the only component found novel is outside the statutory classes of invention, the claim may be rejected under 35 U. S. C. § 101." *In re Chatfield*, 545 F. 2d 152, 158 (CCPA 1976).[16] Our approach to respondent's application is, however, not at all inconsistent with the view that a patent claim must be considered as a whole. Respondent's process is unpatentable under § 101, not because it contains a mathematical algorithm as one component, but because once that algorithm is assumed to be within the prior art, the application, considered as a whole, contains no patentable invention. Even though a phenomenon of nature or mathematical formula may be well known, an inventive application of the principle may be patented. Conversely, the discovery of such a phenomenon cannot support a patent unless there is some other inventive concept in its application.

Here it is absolutely clear that respondent's application contains no claim of patentable invention. The chemical processes involved in catalytic conversion of hydrocarbons are well known, as are the practice of monitoring the chemical process variables, the use of alarm limits to trigger alarms, the notion that alarm limit values must be recomputed and readjusted, and the use of computers for "automatic monitoring-alarming."[17] Respondent's application simply provides a new and presumably better method for calculating alarm limit

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[16] Section 103, by its own terms, requires that a determination of obviousness be made by considering "the subject matter as a whole." 35 U. S. C. § 103. Although this does not necessarily require that analysis of what is patentable *subject matter* under § 101 proceed on the same basis. we agree that it should.

[17] App. 22.

values. If we assume that that method was also known, as we must under the reasoning in *Morse*, then respondent's claim is, in effect, comparable to a claim that the formula $2\pi r$ can be usefully applied in determining the circumference of a wheel.[18] As the Court of Customs and Patent Appeals has explained, "if a claim is directed essentially to a method of calculating, using a mathematical formula, even if the solution is for a specific purpose, the claimed method is nonstatutory." *In re Richman*, 563 F. 2d 1026, 1030 (1977).

To a large extent our conclusion is based on reasoning derived from opinions written before the modern business of developing programs for computers was conceived. The youth of the industry may explain the complete absence of precedent supporting patentability. Neither the dearth of precedent, nor this decision, should therefore be interpreted as reflecting a judgment that patent protection of certain novel and useful computer programs will not promote the progress of science and the useful arts, or that such protection is undesirable as a matter of policy. Difficult questions of policy concerning the kinds of programs that may be appropriate for patent protection and the form and duration of such protection can be answered by Congress on the basis of current empirical data not equally available to this tribunal.[19]

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[18] Respondent argues that the inventiveness of his process must be determined as of "the time the invention is made" under § 103, and that, therefore, it is improper to judge the obviousness of his process by assessing the application of the formula as though the formula were part of the prior art. This argument confuses the issue of patentable subject matter under § 101 with that of obviousness under § 103. Whether or not respondent's formula can be characterized as "obvious," his process patent rests solely on the claim that his mathematical algorithm, when related to a computer program, will improve the existing process for updating alarm units. Very simply, our holding today is that a claim for an improved method of calculation, even when tied to a specific end use, is unpatentable subject matter under § 101.

[19] Articles assessing the merits and demerits of patent protection for computer programming are numerous. See, *e. g.*, Davis, Computer Pro-

It is our duty to construe the patent statutes as they now read, in light of our prior precedents, and we must proceed cautiously when we are asked to extend patent rights into areas wholly unforeseen by Congress. As MR. JUSTICE WHITE explained in writing for the Court in *Deepsouth Packing Co. v. Laitram Corp.*, 406 U. S. 518, 531:

> "[W]e should not expand patent rights by overruling or modifying our prior cases construing the patent statutes, unless the argument for expansion of privilege is based on more than mere inference from ambiguous statutory language. We would require a clear and certain signal from Congress before approving the position of a litigant who, as respondent here, argues that the beachhead of privilege is wider, and the area of public use narrower, than courts had previously thought. No such signal legitimizes respondent's position in this litigation."

The judgment of the Court of Customs and Patent Appeals is

Reversed.

APPENDIX TO OPINION OF THE COURT

Claim 1 of the patent describes the method as follows:

> "1. A method for updating the value of at least one alarm limit on at least one process variable involved in a process comprising the catalytic chemical conversion of hydrocarbons wherein said alarm limit has a current value of

$$Bo + K$$

> "wherein Bo is the current alarm base and K is a predetermined alarm offset which comprises:

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grams and Subject Matter Patentability, 6 Rutgers J. of Computers and Law 1 (1977), and articles cited therein, at 2 n. 5. Even among those who favor patentability of computer programs, there is questioning of whether the 17-year protection afforded by the current Patent Act is either needed or appropriate. See *id.*, at 20 n. 133.

"(1) Determining the present value of said process variable, said present value being defined as PVL;

"(2) Determining a new alarm base B_1, using the following equation:

$$B_1 = B_0(1.0 - F) + PVL(F)$$

"where F is a predetermined number greater than zero and less than 1.0;

"(3) Determining an updated alarm limit which is defined as $B_1 + K$; and thereafter

"(4) Adjusting said alarm limit to said updated alarm limit value."   App. 63A.

In order to use respondent's method for computing a new limit, the operator must make four decisions. Based on his knowledge of normal operating conditions, he first selects the original "alarm base" (Bo); if a temperature of 400 degrees is normal, that may be the alarm base. He next decides on an appropriate margin of safety, perhaps 50 degrees; that is his "alarm offset" (K). The sum of the alarm base and the alarm offset equals the alarm limit. Then he decides on the time interval that will elapse between each updating; that interval has no effect on the computation although it may, of course, be of great practical importance. Finally, he selects a weighting factor (F), which may be any number between 99% and 1%,* and which is used in the updating calculation.

If the operator has decided in advance to use an original alarm base (Bo) of 400 degrees, a constant alarm offset (K) of 50 degrees, and a weighting factor (F) of 80%, the only additional information he needs in order to compute an updated alarm limit (UAV), is the present value of the process variable (PVL). The computation of the updated alarm limit according to respondent's method involves these three steps:

First, at the predetermined interval, the process variable

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*More precisely, it is defined as a number greater than 0, but less than 1.

is measured; if we assume the temperature is then 425 degrees, PVL will then equal 425.

Second, the solution of respondent's novel formula will produce a new alarm base (B_1) that will be a weighted average of the preceding alarm base (Bo) of 400 degrees and the current temperature (PVL) of 425. It will be closer to one or the other depending on the value of the weighting factor (F) selected by the operator. If F is 80%, that percentage of 425 (340) plus 20% (1—F) of 400 (80) will produce a new alarm base of 420 degrees.

Third, the alarm offset (K) of 50 degrees is then added to the new alarm base (B_1) of 420 to produce the updated alarm limit (UAV) of 470.

The process is repeated at the selected time intervals. In each updating computation, the most recently calculated alarm base and the current measurement of the process variable will be substituted for the corresponding numbers in the original calculation, but the alarm offset and the weighting factor will remain constant.

MR. JUSTICE STEWART, with whom THE CHIEF JUSTICE and MR. JUSTICE REHNQUIST join, dissenting.

It is a commonplace that laws of nature, physical phenomena, and abstract ideas are not patentable subject matter.[1] A patent could not issue, in other words, on the law of gravity, or the multiplication tables, or the phenomena of magnetism, or the fact that water at sea level boils at 100 degrees centigrade and freezes at zero—even though newly discovered. *Le Roy* v. *Tatham*, 14 How. 156, 175; *O'Reilly* v. *Morse*, 15 How. 62, 112-121; *Rubber-Tip Pencil Co.* v. *Howard*, 20 Wall.

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[1] Title 35 U. S. C. § 101 provides:

"Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title."

498, 507; *Tilghman v. Proctor*, 102 U. S. 707; *Mackay Radio & Telegraph Co. v. Radio Corp. of America*, 306 U. S. 86, 94; *Funk Bros. Seed Co. v. Kalo Co.*, 333 U. S. 127, 130.

The recent case of *Gottschalk v. Benson*, 409 U. S. 63, stands for no more than this long-established principle, which the Court there stated in the following words:

> "Phenomena of nature, though just discovered, mental processes, and abstract intellectual concepts are not patentable, as they are the basic tools of scientific and technological work." *Id.*, at 67.

In *Benson* the Court held unpatentable claims for an algorithm that "were not limited to any particular art or technology, to any particular apparatus or machinery, or to any particular end use." *Id.*, at 64. A patent on such claims, the Court said, "would wholly pre-empt the mathematical formula and in practical effect would be a patent on the algorithm itself." *Id.*, at 72.

The present case is a far different one. The issue here is whether a claimed process [2] loses its status of subject-matter patentability simply because *one step* in the process would not be patentable subject matter if considered in isolation. The Court of Customs and Patent Appeals held that the process is patentable subject matter, *Benson* being inapplicable since "[t]he present claims do not preempt the formula or algorithm contained therein, because solution of the algorithm, per se, would not infringe the claims." *In re Flook*, 559 F. 2d 21, 23.

That decision seems to me wholly in conformity with basic principles of patent law. Indeed, I suppose that thousands of processes and combinations have been patented that contained one or more steps or elements that themselves would have been

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[2] Title 35 U. S. C. § 100 (b) provides:

"The term 'process' means process, art or method, and includes a new use of a known process, machine, manufacture, composition of matter, or material."

unpatentable subject matter.[3] *Eibel Process Co.* v. *Minnesota & Ontario Paper Co.*, 261 U. S. 45, is a case in point. There the Court upheld the validity of an improvement patent that made use of the law of gravity, which by itself was clearly unpatentable. See also, *e. g., Tilghman* v. *Proctor, supra.*

The Court today says it does not turn its back on these well-settled precedents, *ante*, at 594, but it strikes what seems to me an equally damaging blow at basic principles of patent law by importing into its inquiry under 35 U. S. C. § 101 the criteria of novelty and inventiveness. Section 101 is concerned only with subject-matter patentability. Whether a patent will actually *issue* depends upon the criteria of §§ 102 and 103, which include novelty and inventiveness, among many others. It may well be that under the criteria of §§ 102 and 103 no patent should issue on the process claimed in this case, because of anticipation, abandonment, obviousness, or for some other reason. But in my view the claimed process clearly meets the standards of subject-matter patentability of § 101.

In short, I agree with the Court of Customs and Patent Appeals in this case, and with the carefully considered opinions of that court in other cases presenting the same basic issue. See *In re Freeman*, 573 F. 2d 1237; *In re Richman*, 563 F. 2d 1026; *In re De Castelet*, 562 F. 2d 1236; *In re Deutsch*, 553 F. 2d 689; *In re Chatfield*, 545 F. 2d 152. Accordingly, I would affirm the judgment before us.

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[3] In *Gottschalk* v. *Benson*, the Court equated process and product patents for the purpose of its inquiry: "We dealt there with a 'product' claim, while the present case deals with a 'process' claim. But we think the same principle applies." 409 U. S., at 67–68.

Appendix C

In re Bradley
600 F.2d 807 (C.C.P.A. 1979).

Specifically, the invention relates to al-
tering or repositioning information in the
computer's system base. The system base
of a computer is a fixed area in main mem-
ory which acts as the root for all informa-
tion structures in the computer. In high
performance computer systems, it is very
advantageous to store portions of the sys-
tem base in "scratchpad" registers[1] located
in the central processing unit (CPU) of the
computer rather than in main memory.
This grea:ly enhances the speed of opera-
tion of the computer because the access
time (the time it takes to retrieve informa-
tion from a given place) associated with the
scratchpad registers is less than that associ-
ated with main memory. A problem arises,
however, because a programmer may wish
to change the positions or content of infor-
mation in the system base which happens to
be located in the scratchpad registers.
These registers are "invisible" to the pro-
grammer since, unlike main memory, they
cannot be accessed by software (computer
programs). Prior art systems altered the
system base information resident in the
scratchpad registers by either reinitializing
the system base (completely reloading the
system base containing the new informa-
tion), a process which consumes a considera-
ble amount of time, or by using software
which takes advantage of the model-de-
pendent properties of the particular com-
puter. The latter method has the undesir-
able effect of resorting to reliance on mod-
el-dependent software, which is unaccepta-
ble to some computer users.

Appellants' invention enables system base
information to be altered without having to

Before MARKEY, Chief Judge, RICH,
BALDWIN, and MILLER, Judges, and
COWEN,[*] Senior Judge.

RICH, Judge.

This appeal is from the decision of the
Patent and Trademark Office (PTO) Board
of Appeals (board) affirming the rejection
of claims 1–6, all of the claims in appellants'
application serial No. 570,331, filed April 21,
1975, for "Switch System Base Mechanism,"
as being drawn to subject matter which is
non-statutory under 85 U.S.C. § 101. We
reverse.

The Invention

Appellants' invention is in the field of
computer technology. It does not relate to
computer applications, i. e., any specific
task that a computer is asked to perform,
but rather to the internal operation of the
computer and its ability to manage effi-
ciently its operation in a multiprogrammed

[*] The Honorable Wilson Cowen, U. S. Court of
Claims, sitting by designation.

1. A scratchpad register, also known as a
scratchpad memory, is a plurality of multibit
storage locations, usually located in the central
processing unit (CPU) of a computer, used for
temporary storage of program information,
operands, and calculation results for use by the
computer's arithmetic and logic unit, and other
information of a temporary nature.

resort to these techniques and their accompanying drawbacks. They accomplish their result by employing a "firmware" module, consisting of hardware elements permanently programmed with a microcode, which directs the data transfers, between the scratchpad registers and the system base located in main memory, which are necessary to effect the alteration.

Claim 1 is representative of the appealed claims:

1. In a multiprogramming computer system having a main memory, a central processing unit (CPU) coupled to said main memory, said (CPU) controlling the state of a plurality of groups of processes being in a running, ready, wait or suspended state, said computer system also having scratchpad registers being accessible to an operating system for controlling said multiprogramming computer system, a data structure for storing coded signals for communicating between said processes and said operating system, and said scratchpad registers, said data structure comprising:

(a) first means in said data structure and communicating with said operating system for storing coded signals indicative of an address for a selected one of said processes;

(b) second means in said first means for storing coded signals indicating priority of said selected one of said processes in relation to others of said processes for obtaining control of said CPU when ready;

(c) third means in said data structure and communicating with said operating system, for storing coded signals indicative of an address for a selected one of said plurality of groups of processes, and,

(d) fourth means coupled to said data structure and said scratchpad registers, for generating signals causing the changing of information in said data structure and said scratchpad registers.

The Rejection

The examiner rejected the appealed claims on the authority of *Gottschalk v. Benson*, 409 U.S. 63, 93 S.Ct. 253, 34 L.Ed.2d 273, 175 USPQ 673 (1972) (hereinafter *Benson*) before the Supreme Court's decision in *Parker v. Flook*, 437 U.S. 584, 98 S.Ct. 2522, 57 L.Ed.2d 451, 198 USPQ 193 (1978) (hereinafter *Flook*). In his final rejection, dated October 27, 1976, the examiner stated that the subject matter "deemed as the invention" is "a data structure" and then made the following analysis:

The term "data structure" as recited in the claim is comprised of four entities described as "first means", "second means", "third means", and "fourth means." Whether these so called "means" are hardware structure which store coded signals for performing a particular function or whether they refer to coded signals representing computer control words per se, any life which the claim may have in view of that which is admittedly old in the art, resides in the "technique" (page 5, line 4) or "switch-system base instruction" (page 5, lines 13 and 14) for solving the problem of changing information of the system base which is located in scratchpad registers which software cannot access (page 4, line 20). The invention then is embodied in the coded signals representing instructions to the computer, the running process word RPW (first means of claim), priority level indicator word PRI (second means), J Table word and G Table word (third means), and micro-instructions of Figures 15c [sic, 15b] and 15c as found in the central store 1301. The invention resides in a "data structure" or an algorithm designed to control the multiprogramming computer to solve the particular problem indicated.

Under the ruling in *Gottschalk v. Benson*, [409 U.S. 63, 93 S.Ct. 253, 34 L.Ed.2d 273] 175 USPQ 673, the instant claims, depending upon a program implemented algorithm for patentability, are deemed nonstatutory subject matter.

Appellants requested reconsideration and argued that their claims are directed to

data structures in hardware which are "specific new, novel and unobvious [in] arrangement." They asserted that by stating that the invention resided in a "technique", the examiner was clearly disregarding the claims and interpreting the invention strictly on the basis of what is found in the specification, because no "technique" is *claimed.* They stated that even if a technique (i. e., process) were claimed, *Benson* does not render all such inventions nonstatutory, and that their invention does not involve a *mathematical* algorithm.[2]

In his Answer before the board, the examiner noted that all of the limitations found in claim 1 were old in the art and that the "claim is thus reciting prior art coupled with subject matter which the U. S. Supreme Court has found to be non-statutory in *Benson.*" Appellants responded in their reply brief that it makes no difference whether individual elements are old in the art and that it is the elements in combination which define the invention as a whole.

The Board

The board rendered its decision on September 20, 1978, after the Supreme Court's decision in *Flook.* After incorrectly stating that none of the claims recited the term "firmware,"[3] the board analyzed appellants' claims element by element, concluding that the only novel arrangement of the recited structures resided in the micropro-

gramming, "which together with its attendant memory hardware appears to constitute firmware."

Apparently on the basis of *Flook,* the board affirmed the rejection because it was of the opinion that the appealed claims are directed to a method of calculation or mathematical algorithm. The board found the claims similar to the claims at issue in *In re Waldbaum,* 559 F.2d 611, 194 USPQ 465 (Cust. & Pat.App.1977), which included language characterized by the board as "obviously related to calculating and mathematical problem solving."[4] Although the claims here at issue do not contain similar mathematical language, the board said that this "does not make the functions attendant the 'means' of appellants' claims any less mathematical or less related to an algorithm within the meaning assigned that term by the USSC in *Benson.*"

To support its conclusion that the appealed claims are mathematical in nature, the board relied on a statement in the specification to the effect that all of the data in the computer are in binary form, but may be interpreted as binary coded decimal, decimal or alphanumeric. We reproduce the board's reasoning in full:

> Since digital computers normally operate in some numerical radix, binary, binary coded decimal, or the like, we consider the operation of appellants' claimed invention to be mathematical.

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2. In *Benson,* the Supreme Court was clearly limiting its discussion to mathematical algorithms:

> The patent sought is on a method of programming a general-purpose digital computer to convert signals from binary-coded decimal form into pure binary form. *A procedure for solving a given type of mathematical problem is known as an "algorithm." The procedures set forth in the present claims are of that kind; that is to say, they are a generalized formulation for programs to solve mathematical problems of converting one form of numerical representation to another.* [409 U.S. at 65, 93 S.Ct. at 254, 175 USPQ at 674 (emphasis ours).]

It is not clear whether the examiner regarded appellants' invention as a mathematical algorithm, but, as will become evident, the board did so regard the invention.

3. Claim 3, as well as dependent claims 4-6, explicitly recites firmware. Firmware is a term of art in the computer field and refers to microinstructions permanently embodied in hardware elements. For a further discussion, see generally Ross, *The Patentability of Computer "Firmware,"* 59 JPOS 731 (1977). We need not and do not decide at this time whether firmware *per se* is statutory under 35 U.S.C. § 101 because the invention *as a whole* is not directed thereto. See our further discussion, infra

4. Waldbaum claim 1 reads in pertinent part:
> a method * * * to count the number of busy lines * * * comparing means * * * to derive the number of 1's in said data word * * *. [Emphasis ours.]

It is clear that this claim recites a mathematical algorithm. It solves a mathematical problem, to wit, counting a number of busy lines in a telephone system.

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Every operation performed in appellants' invention as claimed involves the accommodation of data and instructions to the size of the registers in memory, and to the positional assignment to the registers in memory by the use of some numerical measure or quantity effected by way of electrical signals. In whatever form the instructions employed in appellants' invention are characterized, numerical or otherwise, we think it is accurate to say that the operation of appellants' structure is mathematical and that the instructions constitute a procedure which is algorithmic in character, to the same degree as that of the Waldbaum structure and that satisfactory operation of the apparatus claimed represents the successful solution of a mathematical problem falling within the definition of algorithm supplied in *Benson* and reiterated in *Flook*.

Here the method of calculation is to be used in the internal operation of the computer system and the claims recite such an end use by means of the functions recited for the various means. A claim for an improved method of calculation, even when tied to a specific end use, is unpatentable subject matter under 35 USC 101, *Flook supra*.

In summary, the board stated that the claims are drawn to apparatus in form only, and couple the apparatus (which it asserts is old in the art) "with subject matter, namely, programming, which is nonstatutory under the *Benson*, *Christensen*,[5] *Waldbaum* and *Flook* cases * * *."

OPINION

The examiner's basis for the rejection is grounded on the erroneous interpretation of the Supreme Court's decision and opinion in *Benson*, namely, that all computer program or program-related inventions are nonstatutory under § 101. Both the Supreme Court[6] and this court[7] have thoroughly repudiated this view. Our decision, therefore, is based solely on the analysis made by the board.

The board said that the claims do not *directly* recite a mathematical formula, algorithm, or method of calculation, but, nevertheless, held the claims to be mathematical in nature. As appears from the quoted portion of the board opinion, the board regarded the fact that digital computers operate in some number radix as conclusive on the issue of whether the appealed claims recite a mathematical algorithm in the *Benson* and *Flook* sense. The board did not, however, direct attention to any specific formula it thought is utilized, or to what, if anything, the mathematical calculations alleged to be present in the claims are directed.

We do not agree with the board. We are constrained to reject its reasoning. Such reasoning leads to the conclusion that any computer-related invention must be regarded as mathematical in nature, a conclusion which is not compelled by either *Benson* or *Flook*.

The board's analysis confuses *what* the computer does with *how* it is done. It is of

5. *In re Christensen*, 478 F.2d 1392, 178 USPQ 35 (Cust. & Pat.App.1973).

6. In *Benson*, the Court stated, 409 U.S. at 71, 93 S.Ct. at 257, 175 USPQ at 676 (emphasis ours):

> It is said that this decision precludes a patent for any program servicing a computer. We do not so hold.

In *Flook*, the Court stated, 437 U.S. at 595 n. 18, 98 S.Ct. at 2528, n. 18, 198 USPQ at 199 n. 18:

> Very simply, our holding today is that a claim for an improved method of calculation, even when tied to a specific end use, is unpatentable subject matter under § 101.

7. *See In re Gelnovatch*, 595 F.2d 32, 36–37, 201 USPQ 136, 141 (Cust. & Pat.App.1979), *In re Johnson*, 589 F.2d 1070, 1075, 200 USPQ 199, 205 (Cust. & Pat.App.1978); *In re Sarkar*, 588 F.2d 1330, 1333, 200 USPQ 132, 137 (Cust. & Pat.App.1978), *In re Freeman*, 573 F.2d 1237, 1244, 197 USPQ 464, 470 (Cust. & Pat.App. 1978), *In re de Castelet*, 562 F.2d 1236, 1240, 195 USPQ 439, 443 (Cust. & Pat.App.1977); *In re Chatfield*, 545 F.2d 152, 155–56, 191 USPQ 730, 733–34 (Cust. & Pat.App.1976), *cert. denied*, 434 U.S. 875, 98 S.Ct. 226, 54 L.Ed.2d 155, 195 USPQ 465 (1977).

course true that a modern digital computer manipulates data, usually in binary form, by performing mathematical operations, such as addition, subtraction, multiplication, division, or bit shifting, on the data. But this is only *how* the computer does what it does. Of importance is the significance of the data and their manipulation in the real world, i. e., *what* the computer is doing. It may represent the solution of the Pythagorean theorem, or a complex vector equation describing the behavior of a rocket in flight, in which case the computer is performing a mathematical algorithm and solving an equation. This is what was involved in *Benson* and *Flook*. On the other hand, it may be that the data and the manipulations performed thereon by the computer, when viewed on the human level, represent the contents of a page of the Milwaukee telephone directory, or the text of a court opinion retrieved by a computerized law service. Such information is utterly devoid of mathematical significance. Thus, the board's analysis does nothing but provide a quick and automatic negative answer to the § 101 question simply because a computer program is involved.

Appellants have continuously insisted that they are claiming a new and unobvious combination of *hardware elements*, i. e., a new machine or apparatus.[8] The issues of novelty and unobviousness[9] are not before us, but we agree with appellants insofar as they characterize their invention as a machine or apparatus. The board likewise seems to agree on this point. In its opinion, it identifies all of the "means" of appellants' claim 1 as structural hardware elements, such as registers, portions of main memory and control store,[10] and other computer components. Thus, the claim falls literally within the boundaries of § 101.

Appellants have characterized their combination of hardware elements as a mechanism which enables the computer to alter information in its system base in a manner not previously possible. They are in no way claiming the altered information; in fact, the particular information acted upon by appellants' invention is irrelevant to the operation of the invention itself. We see no difference in this regard, with respect to being within § 101, between appellants' claimed invention and a strictly mechanical adding machine, which is certainly statutory if claimed in a manner which does not embrace any particular calculation that the machine is capable of making.

The PTO regards as significant the fact that firmware is involved in the present invention. In a sense, firmware may be likened to software (computer programs); it is information which has been embodied into hardware by, for example, destroying fusible links in a read only memory (ROM) array. In appellants' invention, the information contained within the firmware, which is located in the control store of the computer, directs the desired information transfers within the system base.

If appellants were claiming the information embodied in the firmware or the firmware itself, per se, a different case would be presented. We express no opinion on the statutory nature of such an invention, a question not before us. Appellants are claiming a combination of hardware elements, one of which happens to be a portion of the computer's control store microprogrammed in a particular manner. It is this subject matter with which we must deal.

From our reading of appellants' specification, their claimed "data structure" is merely that which results from the arrangement of the recited hardware elements in the claimed manner. It is the result of certain

8. 35 U.S.C. § 101 states:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title. [Emphasis ours.]

9. 35 U.S.C. §§ 102, 103.

10. The control store of a computer is a plurality of multibit storage locations (memory) containing microinstructions, which, when decoded by appropriate circuitry, provide control signals which cause specific operations to take place in the computer's CPU.

structural "means" performing certain recited functions as explicitly sanctioned by 35 U.S.C. § 112, sixth paragraph. We disapprove the board's distillation of appellants' claim down to the information contained in the firmware in order to hold it nonstatutory. The invention is not claimed in that manner, and, in this case, we see no reason to view the claim format as a subterfuge for masking the presence of an essentially nonstatutory invention.

Even though the claimed invention is a machine, we must nevertheless determine whether the claim recites a mathematical algorithm, and, if so, whether it preempts the use of the algorithm. *In re Noll*, 545 F.2d 141, 148, 191 USPQ 721, 726 (Cust. & Pat.App.1976). In doing so, we apply the two-step test in *In re Freeman*, supra note 7.

When we examine appellants' invention as a whole under the first step of this test, including the information microprogrammed into the firmware element as depicted in Figs. 14(a-i) and 15(b-c), we fail to detect the presence of any *mathematical* algorithm. In altering information in the system base as desired, certain "calculations" are made, such as determining whether a given quantity is equal to zero, or, as noted by the solicitor, multiplying an address in memory by sixteen to arrive at another address. However, it certainly cannot be said that comparing with zero or multiplying by sixteen is preempted by appellants' claims. Furthermore, the presence of these calculations does not transform the invention as a whole into a method of calculation. *Cf. In re Gelnovatch*, supra note 7. There is no solution of an equation, such as the new alarm limit in *Flook*, or the equivalent pure binary number, as in *Benson*, present in the computer after the task has been completed. *See In re Chatfield*, supra note 7.

In summary, we have examined the claims thoroughly and we do not find any mathematical formula or mathematical method of calculation, improved or otherwise, which is either claimed as such or essential to the vitality of the claims. We find that the invention is a combination of tangible hardware elements—a machine—including some hardware elements which contain microprogrammed information termed "firmware." We do not find the invention to be nonstatutory under the authority of *Benson* or *Flook*, or under the authority of our own cases, such as those cited at note 7 ante. Therefore, the decision of the board is *reversed*.

REVERSED.

Appendix D

Diamond v. Diehr
450 U.S. 175, 101 S. Ct. 1048 (1981).

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DIAMOND, COMMISSIONER OF PATENTS AND
TRADEMARKS v. DIEHR ET AL.

CERTIORARI TO THE UNITED STATES COURT OF CUSTOMS AND
PATENT APPEALS

No. 79-1112.   Argued October 14, 1980—Decided March 3, 1981

Respondents filed a patent application claiming invention for a process
for molding raw, uncured synthetic rubber into cured precision products.
While it was possible, by using well-known time, temperature, and cure
relationships, to calculate by means of an established mathematical
equation when to open the molding press and remove the cured product,
according to respondents the industry had not been able to measure
precisely the temperature *inside* the press, thus making it difficult to
make the necessary computations to determine the proper cure time.
Respondents characterized their contribution to the art to reside in the
process of constantly measuring the temperature inside the mold and
feeding the temperature measurements into a computer that repeatedly
recalculates the cure time by use of the mathematical equation and then
signals a device to open the press at the proper time. The patent
examiner rejected respondents' claims on the ground that they were
drawn to nonstatutory subject matter under 35 U. S. C. § 101, which
provides for the issuance of patents to "[w]hoever invents or discovers
any new and useful *process*, machine, manufacture, or composition of
matter, or any new and useful improvement thereof . . . ." The Patent
and Trademark Office Board of Appeals agreed, but the Court of Cus-
toms and Patent Appeals reversed.

Held: Respondents' claims recited subject matter that was eligible for
patent protection under § 101. Pp. 181-193.

   (a) For purposes of § 101, a "process" is "an act, or a series of acts,
performed upon the subject-matter to be transformed and reduced to a
different state or thing. If new and useful, it is just as patentable as
is a piece of machinery. . . . The machinery pointed out as suitable to
perform the process may or may not be new or patentable." *Cochrane*
v. *Deener*, 94 U. S. 780, 788. Industrial processes such as respondents'
claims for transforming raw, uncured synthetic rubber into a different
state or thing are the types which have historically been eligible to re-
ceive patent-law protection. Pp. 181-184.

   (b) While a mathematical formula, like a law of nature, cannot be the
subject of a patent, cf. *Gottschalk* v. *Benson*, 409 U. S. 63; *Parker* v.

Flook, 437 U. S. 584, respondents do not seek to patent a mathematical formula, but instead seek protection for a process of curing synthetic rubber. Although their process employs a well-known mathematical equation, they do not seek to pre-empt the use of that equation, except in conjunction with all of the other steps in their claimed process. A claim drawn to subject matter otherwise statutory does not become nonstatutory simply because it uses a mathematical formula, computer program, or digital computer. Respondents' claims must be considered as a whole, it being inappropriate to dissect the claims into old and new elements and then to ignore the presence of the old elements in the analysis. The questions of whether a particular invention meets the "novelty" requirements of 35 U. S. C. § 102 or the "nonobviousness" requirements of § 103 do not affect the determination of whether the invention falls into a category of subject matter that is eligible for patent protection under § 101. Pp. 185–191.

(c) When a claim containing a mathematical formula implements or applies the formula in a structure or process which, when considered as a whole, is performing a function which the patent laws were designed to protect (*e. g.*, transforming or reducing an article to a different state or thing), then the claim satisfies § 101's requirements. Pp. 191–193.

602 F. 2d 982, affirmed.

REHNQUIST, J., delivered the opinion of the Court, in which BURGER, C. J., and STEWART, WHITE, and POWELL, JJ., joined. STEVENS, J., filed a dissenting opinion, in which BRENNAN, MARSHALL, and BLACKMUN, JJ., joined, *post*, p. 193.

Deputy Solicitor General Wallace argued the cause for petitioner. With him on the briefs were *Solicitor General McCree, Assistant Attorney General Litvack, Harriet S. Shapiro, Robert B. Nicholson, Frederic Freilicher, Joseph F. Nakamura*, and *Thomas E. Lynch*.

Robert E. Wickersham argued the cause for respondents. With him on the brief were *Robert F. Hess, Jay M. Cantor*, and *Thomas M. Freiburger.**

*Edward S. Irons, Mary Helen Sears, and *Robert P. Beshar* filed a brief for National Semiconductor Corp. as *amicus curiae* urging reversal.

Briefs of *amici curiae* urging affirmance were filed by *Donald R. Dunner, Kenneth E. Kuffner*, and *Travis Gordon White* for the American Patent

JUSTICE REHNQUIST delivered the opinion of the Court.

We granted certiorari to determine whether a process for curing synthetic rubber which includes in several of its steps the use of a mathematical formula and a programmed digital computer is patentable subject matter under 35 U. S. C. § 101.

I

The patent application at issue was filed by the respondents on August 6, 1975. The claimed invention is a process for molding raw, uncured synthetic rubber into cured precision products. The process uses a mold for precisely shaping the uncured material under heat and pressure and then curing the synthetic rubber in the mold so that the product will retain its shape and be functionally operative after the molding is completed.[1]

Respondents claim that their process ensures the production of molded articles which are properly cured. Achieving the perfect cure depends upon several factors including the thickness of the article to be molded, the temperature of the molding process, and the amount of time that the article is allowed to remain in the press. It is possible using well-known time, temperature, and cure relationships to calculate by means of the Arrhenius equation [2] when to open the press

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Law Association, Inc.; by *Morton C. Jacobs* for Applied Data Research, Inc.; by *William L. Mathis* and *Harold D. Messner* for Chevron Research Co.; and by *Reed C. Lawlor* and *James W. Geriak* for the Los Angeles Patent Law Association.

[1] A "cure" is obtained by mixing curing agents into the uncured polymer in advance of molding, and then applying heat over a period of time. If the synthetic rubber is cured for the right length of time at the right temperature, it becomes a usable product.

[2] The equation is named after its discoverer Svante Arrhenius and has long been used to calculate the cure time in rubber-molding presses. The equation can be expressed as follows:

$$\ln v = CZ + x$$

wherein ln v is the natural logarithm of v, the total required cure time;

and remove the cured product. Nonetheless, according to the respondents, the industry has not been able to obtain uniformly accurate cures because the temperature of the molding press could not be precisely measured, thus making it difficult to do the necessary computations to determine cure time.[*] Because the temperature *inside* the press has heretofore been viewed as an uncontrollable variable, the conventional industry practice has been to calculate the cure time as the shortest time in which all parts of the product will definitely be cured, assuming a reasonable amount of mold-opening time during loading and unloading. But the shortcoming of this practice is that operating with an uncontrollable variable inevitably led in some instances to overestimating the mold-opening time and overcuring the rubber, and in other instances to underestimating that time and undercuring the product.[4]

Respondents characterize their contribution to the art to reside in the process of constantly measuring the actual temperature inside the mold. These temperature measurements are then automatically fed into a computer which repeatedly recalculates the cure time by use of the Arrhenius equation.

_____

C is the activation constant, a unique figure for each batch of each compound being molded, determined in accordance with rheometer measurements of each batch; Z is the temperature in the mold; and x is a constant dependent on the geometry of the particular mold in the press. A rheometer is an instrument to measure flow of viscous substances.

[*] During the time a press is open for loading, it will cool. The longer it is open, the cooler it becomes and the longer it takes to reheat the press to the desired temperature range. Thus, the time necessary to raise the mold temperature to curing temperature is an unpredictable variable. The respondents claim to have overcome this problem by continuously measuring the actual temperature in the closed press through the use of a thermocouple.

[4] We note that the petitioner does not seriously contest the respondents' assertions regarding the inability of the industry to obtain accurate cures on a uniform basis. See Brief for Petitioner 3.

When the recalculated time equals the actual time that has elapsed since the press was closed, the computer signals a device to open the press. According to the respondents, the continuous measuring of the temperature inside the mold cavity, the feeding of this information to a digital computer which constantly recalculates the cure time, and the signaling by the computer to open the press, are all new in the art.

The patent examiner rejected the respondents' claims on the sole ground that they were drawn to nonstatutory subject matter under 35 U. S. C. § 101.[5] He determined that those

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[5] Respondents' application contained 11 different claims. Three examples are claims 1, 2, and 11 which provide:

"1. A method of operating a rubber-molding press for precision molded compounds with the aid of a digital computer, comprising:

"providing said computer with a data base for said press including at least,

"natural logarithm conversion data (ln),

"the activation energy constant (C) unique to each batch of said compound being molded, and

"a constant (x) dependent upon the geometry of the particular mold of the press,

"initiating an interval timer in said computer upon the closure of the press for monitoring the elapsed time of said closure,

"constantly determining the temperature (Z) of the mold at a location closely adjacent to the mold cavity in the press during molding,

"constantly providing the computer with the temperature (Z),

"repetitively calculating in the computer, at frequent intervals during each cure, the Arrhenius equation for reaction time during the cure, which is

"ln $v = CZ + x$

"where v is the total required cure time,

"repetitively comparing in the computer at said frequent intervals during the cure each said calculation of the total required cure time calculated with the Arrhenius equation and said elapsed time, and

"opening the press automatically when a said comparison indicates equivalence.

"2. The method of claim 1 including measuring the activation energy constant for the compound being molded in the press with a rheometer and automatically updating said data base within the computer in the

steps in respondents' claims that are carried out by a computer under control of a stored program constituted nonstatutory subject matter under this Court's decision in *Gottschalk* v. *Benson,* 409 U. S. 63 (1972). The remaining steps—installing rubber in the press and the subsequent closing of the

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event of changes in the compound being molded in said press as measured by said rheometer.

.   , ...

"11. A method of manufacturing precision molded articles from selected synthetic rubber compounds in an openable rubber molding press having at least one heated precision mold, comprising:

"(a) heating said mold to a temperature range approximating a predetermined rubber curing temperature,

"(b) installing prepared unmolded synthetic rubber of a known compound in a molding cavity of predetermined geometry as defined by said mold,

"(c) closing said press to mold said rubber to occupy said cavity in conformance with the contour of said mold and to cure said rubber by transfer of heat thereto from said mold,

"(d) initiating an interval timer upon the closure of said press for monitoring the elapsed time of said closure,

"(e) heating said mold during said closure to maintain the temperature thereof within said range approximating said rubber curing temperature,

"(f) constantly determining the temperature of said mold at a location closely adjacent said cavity thereof throughout closure of said press,

"(g) repetitively calculating at frequent periodic intervals throughout closure of said press the Arrhenius equation for reaction time of said rubber to determine total required cure time v as follows:

"$\ln v = cz + x$

"wherein c is an activation energy constant determined for said rubber being molded and cured in said press, z is the temperature of said mold at the time of each calculation of said Arrhenius equation, and x is a constant which is a function of said predetermined geometry of said mold,

"(h) for each repetition of calculation of said Arrhenius equation herein, comparing the resultant calculated total required cure time with the monitored elapsed time measured by said interval timer,

"(i) opening said press when a said comparison of calculated total required cure time and monitored elapsed time indicates equivalence, and

"(j) removing from said mold the resultant precision molded and cured rubber article."

press—were "conventional and necessary to the process and cannot be the basis of patentability." The examiner concluded that respondents' claims defined and sought protection of a computer program for operating a rubber-molding press.

The Patent and Trademark Office Board of Appeals agreed with the examiner, but the Court of Customs and Patent Appeals reversed. *In re Diehr*, 602 F. 2d 892 (1979). The court noted that a claim drawn to subject matter otherwise statutory does not become nonstatutory because a computer is involved. The respondents' claims were not directed to a mathematical algorithm or an improved method of calculation but rather recited an improved process for molding rubber articles by solving a practical problem which had arisen in the molding of rubber products.

The Commissioner of Patents and Trademarks sought certiorari arguing that the decision of the Court of Customs and Patent Appeals was inconsistent with prior decisions of this Court. Because of the importance of the question presented, we granted the writ. 445 U. S. 926 (1980).

II

Last Term in *Diamond* v. *Chakrabarty*, 447 U. S. 303 (1980), this Court discussed the historical purposes of the patent laws and in particular 35 U. S. C. § 101. As in *Chakrabarty*, we must here construe 35 U. S. C. § 101 which provides:

> "Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title."⁕

⁕ The word "process" is defined in 35 U. S. C. § 100 (b):

"The term 'process' means process, art or method, and includes a new use of a known process, machine, manufacture, composition of matter, or material."

In cases of statutory construction, we begin with the language of the statute. Unless otherwise defined, "words will be interpreted as taking their ordinary, contemporary. common meaning," *Perrin* v. *United States*, 444 U. S. 37, 42 (1979), and, in dealing with the patent laws, we have more than once cautioned that "courts 'should not read into the patent laws limitations and conditions which the legislature has not expressed.'" *Diamond* v. *Chakrabarty*, *supra*, at 308, quoting *United States* v. *Dubilier Condenser Corp.*, 289 U. S. 178, 199 (1933).

The Patent Act of 1793 defined statutory subject matter as "any new and useful art, machine, manufacture or composition of matter, or any new or useful improvement [thereof]." Act of Feb. 21, 1793, ch. 11, § 1, 1 Stat. 318. Not until the patent laws were recodified in 1952 did Congress replace the word "art" with the word "process." It is that latter word which we confront today, and in order to determine its meaning we may not be unmindful of the Committee Reports accompanying the 1952 Act which inform us that Congress intended statutory subject matter to "include anything under the sun that is made by man." S. Rep. No. 1979, 82d Cong., 2d Sess., 5 (1952); H. R. Rep. No. 1923, 82d Cong., 2d Sess., 6 (1952).

Although the term "process" was not added to 35 U. S. C. § 101 until 1952, a process has historically enjoyed patent protection because it was considered a form of "art" as that term was used in the 1793 Act.[7] In defining the nature of a patentable process, the Court stated:

"That a process may be patentable, irrespective of the

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[7] In *Corning* v. *Burden*, 15 How. 252, 267–268 (1854), this Court explained:

"A process, *eo nomine*, is not made the subject of a patent in our act of congress. It is included under the general term 'useful art.' An art may require one or more processes or machines in order to produce a certain result or manufacture. The term machine includes every mechanical device or combination of mechanical powers and devices to perform some

particular form of the instrumentalities used, cannot be
disputed. . . . A process is a mode of treatment of
certain materials to produce a given result. It is an act,
or a series of acts, performed upon the subject-matter to
be transformed and reduced to a different state or thing.
If new and useful, it is just as patentable as is a piece
of machinery. In the language of the patent law, it is
an art. The machinery pointed out as suitable to per-
form the process may or may not be new or patentable;
whilst the process itself may be altogether new, and
produce an entirely new result. The process requires

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function and produce a certain effect or result. But where the result or
effect is produced by chemical action, by the operation or application of
some element or power of nature, or of one substance to another, such
modes, methods, or operations, are called processes. A new process is
usually the result of discovery; a machine, of invention. The arts of tan-
ning, dyeing, making water-proof cloth, vulcanizing India rubber, smelting
ores, and numerous others, are usually carried on by processes as dis-
tinguished from machines. One may discover a new and useful improve-
ment in the process of tanning, dyeing, &c., irrespective of any particular
form of machinery or mechanical device. And another may invent a
labor-saving machine by which this operation or process may be per-
formed, and each may be entitled to his patent. As, for instance, A has
discovered that by exposing India rubber to a certain degree of heat, in
mixture or connection with certain metalic salts, he can produce a valuable
product, or manufacture; he is entitled to a patent for his discovery, as a
process or improvement in the art, irrespective of any machine or mechani-
cal device. B, on the contrary, may invent a new furnace or stove, or
steam apparatus, by which this process may be carried on with much
saving of labor, and expense of fuel; and he will be entitled to a patent for
his machine, as an improvement in the art. Yet A could not have a
patent for a machine, or B for a process; but each would have a patent
for the means or method of producing a certain result, or effect, and not
for the result or effect produced. It is for the discovery or invention of
some practical method or means of producing a beneficial result or effect,
that a patent is granted, and not for the result or effect itself. It is when
the term process is used to represent the means or method of producing a
result that it is patentable, and it will include all methods or means which
are not effected by mechanism or mechanical combinations."

that certain things should be done with certain sub-
stances, and in a certain order; but the tools to be used
in doing this may be of secondary consequence." *Coch-
rane* v. *Deener*, 94 U. S. 780, 787–788 (1877).

Analysis of the eligibility of a claim of patent protection
for a "process" did not change with the addition of that term
to § 101. Recently, in *Gottschalk* v. *Benson*, 409 U. S. 63
(1972), we repeated the above definition recited in *Cochrane*
v. *Deener*, adding: "Transformation and reduction of an ar-
ticle 'to a different state or thing' is the clue to the patent-
ability of a process claim that does not include particular
machines." 409 U. S., at 70.

Analyzing respondents' claims according to the above state-
ments from our cases, we think that a physical and chemical
process for molding precision synthetic rubber products falls
within the § 101 categories of possibly patentable subject
matter. That respondents' claims involve the transforma-
tion of an article, in this case raw, uncured synthetic rubber,
into a different state or thing cannot be disputed. The re-
spondents' claims describe in detail a step-by-step method for
accomplishing such, beginning with the loading of a mold
with raw, uncured rubber and ending with the eventual open-
ing of the press at the conclusion of the cure. Industrial
processes such as this are the types which have historically
been eligible to receive the protection of our patent laws.[8]

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[8] We note that as early as 1854 this Court approvingly referred to
patent eligibility of processes for curing rubber. See *id.*, at 267; n. 7,
supra. In *Tilghman* v. *Proctor*, 102 U. S. 707 (1881), we referred to the
original patent Charles Goodyear received on his process for "vulcanizing"
or curing rubber. We stated:

"That a patent can be granted for a process, there can be no doubt.
The patent law is not confined to new machines and new compositions of
matter, but extends to any new and useful art or manufacture. A manu-
facturing process is clearly an art, within the meaning of the law. Good-
year's patent was for a process, namely, the process of vulcanizing india-
rubber by subjecting it to a high degree of heat when mixed with sulphur

III

Our conclusion regarding respondents' claims is not altered by the fact that in several steps of the process a mathematical equation and a programmed digital computer are used. This Court has undoubtedly recognized limits to § 101 and every discovery is not embraced within the statutory terms. Excluded from such patent protection are laws of nature, natural phenomena, and abstract ideas. See *Parker* v. *Flook*, 437 U. S. 584 (1978); *Gottschalk* v. *Benson, supra*, at 67; *Funk Bros. Seed Co.* v. *Kalo Inoculant Co.*, 333 U. S. 127, 130 (1948). "An idea of itself is not patentable," *Rubber-Tip Pencil Co.* v. *Howard*, 20 Wall. 498, 507 (1874). "A principle, in the abstract, is a fundamental truth; an original cause; a motive; these cannot be patented, as no one can claim in either of them an exclusive right." *Le Roy* v. *Tatham*, 14 How. 156, 175 (1853). Only last Term, we explained:

> "[A] new mineral discovered in the earth or a new plant found in the wild is not patentable subject matter. Likewise, Einstein could not patent his celebrated law that $E=mc^2$; nor could Newton have patented the law of gravity. Such discoveries are 'manifestations of . . . nature, free to all men and reserved exclusively to none.' " *Diamond* v. *Chakrabarty*, 447 U. S., at 309, quoting *Funk Bros. Seed Co.* v. *Kalo Inoculant Co., supra*, at 130.

Our recent holdings in *Gottschalk* v. *Benson, supra*, and *Parker* v. *Flook, supra*, both of which are computer-related, stand for no more than these long-established principles. In *Benson*, we held unpatentable claims for an algorithm used to convert binary code decimal numbers to equivalent pure binary numbers. The sole practical application of the algorithm was in connection with the programming of a

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and a mineral salt. The apparatus for performing the process was not patented, and was not material. The patent pointed out how the process could be effected, and that was deemed sufficient." *Id.*, at 722.

general purpose digital computer. We defined "algorithm" as a "procedure for solving a given type of mathematical problem," and we concluded that such an algorithm, or mathematical formula, is like a law of nature, which cannot be the subject of a patent.[*]

Parker v. *Flook, supra,* presented a similar situation. The claims were drawn to a method for computing an "alarm limit." An "alarm limit" is simply a number and the Court concluded that the application sought to protect a formula for computing this number. Using this formula, the updated alarm limit could be calculated if several other variables were known. The application, however, did not purport to explain how these other variables were to be determined,[10] nor

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[*] The term "algorithm" is subject to a variety of definitions. The petitioner defines the term to mean:

" '1. A fixed step-by-step procedure for accomplishing a given result; usually a simplified procedure for solving a complex problem, also a full statement of a finite number of steps. 2. A defined process or set of rules that leads [*sic*] and assures development of a desired output from a given input. A sequence of formulas and/or algebraic/logical steps to calculate or determine a given task; processing rules.' " Brief for Petitioner in *Diamond* v. *Bradley,* O. T. 1980, No. 79–855, p. 6, n. 12, quoting C. Sippl & R. Sippl, Computer Dictionary and Handbook 23 (2d ed. 1972).

This definition is significantly broader than the definition this Court employed in *Benson* and *Flook.* Our previous decisions regarding the patentability of "algorithms" are necessarily limited to the more narrow definition employed by the Court, and we do not pass judgment on whether processes falling outside the definition previously used by this Court, but within the definition offered by the petitioner, would be patentable subject matter.

[10] As we explained in *Flook,* in order for an operator using the formula to calculate an updated alarm limit the operator would need to know the original alarm base, the appropriate margin of safety, the time interval that should elapse between each updating, the current temperature (or other process variable), and the appropriate weighing factor to be used to average the alarm base and the current temperature. 437 U. S., at 586. The patent application did not "explain how to select the approximate margin of safety, the weighing factor, or any of the other variables." *Ibid.*

did it purport "to contain any disclosure relating to the chemical processes at work, the monitoring of process variables, or the means of setting off an alarm or adjusting an alarm system. All that it provides is a formula for computing an updated alarm limit." 437 U. S., at 586.

In contrast, the respondents here do not seek to patent a mathematical formula. Instead, they seek patent protection for a process of curing synthetic rubber. Their process admittedly employs a well-known mathematical equation, but they do not seek to pre-empt the use of that equation. Rather, they seek only to foreclose from others the use of that equation in conjunction with all of the other steps in their claimed process. These include installing rubber in a press, closing the mold, constantly determining the temperature of the mold, constantly recalculating the appropriate cure time through the use of the formula and a digital computer, and automatically opening the press at the proper time. Obviously, one does not need a "computer" to cure natural or synthetic rubber, but if the computer use incorporated in the process patent significantly lessens the possibility of "overcuring" or "undercuring," the process as a whole does not thereby become unpatentable subject matter.

Our earlier opinions lend support to our present conclusion that a claim drawn to subject matter otherwise statutory does not become nonstatutory simply because it uses a mathematical formula, computer program, or digital computer. In *Gottschalk* v. *Benson* we noted: "It is said that the decision precludes a patent for any program servicing a computer. We do not so hold." 409 U. S., at 71. Similarly, in *Parker* v. *Flook* we stated that "a process is not unpatentable simply because it contains a law of nature or a mathematical algorithm." 437 U. S., at 590. It is now commonplace that an *application* of a law of nature or mathematical formula to a known structure or process may well be deserving of patent protection. See, *e. g., Funk Bros. Seed*

Co. v. *Kalo Inoculant Co.*, 333 U. S. 127 (1948); *Eibel Process Co.* v. *Minnesota & Ontario Paper Co.*, 261 U. S. 45 (1923); *Cochrane* v. *Deener*, 94 U. S. 780 (1877); *O'Reilly* v. *Morse*, 15 How. 62 (1854); and *Le Roy* v. *Tatham*, 14 How. 156 (1853). As Justice Stone explained four decades ago:

> "While a scientific truth, or the mathematical expression of it, is not a patentable invention, a novel and useful structure created with the aid of knowledge of scientific truth may be." *Mackay Radio & Telegraph Co.* v. *Radio Corp. of America*, 306 U. S. 86, 94 (1939).[11]

We think this statement in *Mackay* takes us a long way toward the correct answer in this case. Arrhenius' equation is not patentable in isolation, but when a process for curing rubber is devised which incorporates in it a more efficient solution of the equation, that process is at the very least not barred at the threshold by § 101.

In determining the eligibility of respondents' claimed process for patent protection under § 101, their claims must be considered as a whole. It is inappropriate to dissect the claims into old and new elements and then to ignore the presence of the old elements in the analysis. This is particularly true in a process claim because a new combination of steps in a process may be patentable even though all the constituents of the combination were well known and in common use before the combination was made. The "novelty" of any element or steps in a process, or even of the

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[11] We noted in *Funk Bros. Seed Co.* v. *Kalo Inoculant Co.*, 333 U. S. 127, 130 (1948):

"He who discovers a hitherto unknown phenomenon of nature has no claim to a monopoly of it which the law recognizes. If there is to be invention from such a discovery, it must come from the application of the law of nature to a new and useful end."

Although we were dealing with a "product" claim in *Funk Bros.*, the same principle applies to a process claim. *Gottschalk* v. *Benson*, 409 U. S. 63, 68 (1972).

process itself, is of no relevance in determining whether the subject matter of a claim falls within the § 101 categories of possibly patentable subject matter.[12]

It has been urged that novelty is an appropriate consideration under § 101. Presumably, this argument results from the language in § 101 referring to any "new and useful" process, machine, etc. Section 101, however, is a general statement of the type of subject matter that is eligible for patent protection "subject to the conditions and requirements of this title." Specific conditions for patentability follow and § 102 covers in detail the conditions relating to novelty.[13]

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[12] It is argued that the procedure of dissecting a claim into old and new elements is mandated by our decision in *Flook* which noted that a mathematical algorithm must be assumed to be within the "prior art." It is from this language that the petitioner premises his argument that if everything other than the algorithm is determined to be old in the art, then the claim cannot recite statutory subject matter. The fallacy in this argument is that we did not hold in *Flook* that the mathematical algorithm could not be considered at all when making the § 101 determination. To accept the analysis proffered by the petitioner would, if carried to its extreme, make all inventions unpatentable because all inventions can be reduced to underlying principles of nature which, once known, make their implementation obvious. The analysis suggested by the petitioner would also undermine our earlier decisions regarding the criteria to consider in determining the eligibility of a process for patent protection. See, e. g., *Gottschalk* v. *Benson, supra;* and *Cochrane* v. *Deener,* 94 U. S. 780 (1877).

[13] Section 102 is titled "Conditions for patentability; novelty and loss of right to patent," and provides:

"A person shall be entitled to a patent unless—

"(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent, or

"(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States, or

"(c) he has abandoned the invention, or

"(d) the invention was first patented or caused to be patented, or was

The question therefore of whether a particular invention is novel is "wholly apart from whether the invention falls into a category of statutory subject matter." *In re Bergy*, 596 F. 2d 952, 961 (CCPA 1979) (emphasis deleted). See also *Nickola* v. *Peterson*, 580 F. 2d 898 (CA6 1978). The legislative history of the 1952 Patent Act is in accord with this reasoning. The Senate Report stated:

"Section 101 sets forth the subject matter that can be patented, 'subject to the conditions and requirements of this title.' The conditions under which a patent may be obtained follow, and *Section 102 covers the conditions relating to novelty.*" S. Rep. No. 1979, 82d Cong., 2d Sess., 5 (1952) (emphasis supplied).

It is later stated in the same Report:

"Section 102, in general, may be said to describe the statutory novelty required for patentability, and in-

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the subject of an inventor's certificate, by the applicant or his legal representatives or assigns in a foreign country prior to the date of the application for patent in this country on an application for patent or inventor's certificate filed more than twelve months before the filing of the application in the United States, or

"(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371 (c) of this title before the invention thereof by the applicant for patent, or

"(f) he did not himself invent the subject matter sought to be patented, or

"(g) before the applicant's invention thereof the invention was made in this country by another who had not abandoned, suppressed, or concealed it. In determining priority of invention there shall be considered not only the respective dates of conception and reduction to practice of the invention, but also the reasonable diligence of one who was first to conceive and last to reduce to practice, from a time prior to conception by the other."

cludes, in effect, an amplification and definition of 'new' in section 101." *Id.,* at 6.

Finally, it is stated in the "Revision Notes":

> "The corresponding section of [the] existing statute is split into two sections, section 101 relating to the subject matter for which patents may be obtained, and section 102 defining statutory novelty and stating other conditions for patentability." *Id.,* at 17.

See also H. R. Rep. No. 1923, 82d Cong., 2d Sess., 6, 7, and 17 (1952).

In this case, it may later be determined that the respondents' process is not deserving of patent protection because it fails to satisfy the statutory conditions of novelty under § 102 or nonobviousness under § 103. A rejection on either of these grounds does not affect the determination that respondents' claims recited subject matter which was eligible for patent protection under § 101.

IV

We have before us today only the question of whether respondents' claims fall within the § 101 categories of possibly patentable subject matter. We view respondents' claims as nothing more than a process for molding rubber products and not as an attempt to patent a mathematical formula. We recognize, of course, that when a claim recites a mathematical formula (or scientific principle or phenomenon of nature), an inquiry must be made into whether the claim is seeking patent protection for that formula in the abstract. A mathematical formula as such is not accorded the protection of our patent laws, *Gottschalk* v. *Benson,* 409 U. S. 63 (1972), and this principle cannot be circumvented by attempting to limit the use of the formula to a particular technological environment. *Parker* v. *Flook,* 437 U. S. 584 (1978). Similarly, insignificant postsolution activity will not trans-

form an unpatentable principle into a patentable process.
Ibid.[14] To hold otherwise would allow a competent drafts-
man to evade the recognized limitations on the type of sub-
ject matter eligible for patent protection. On the other hand,
when a claim containing a mathematical formula implements
or applies that formula in a structure or process which, when
considered as a whole, is performing a function which the
patent laws were designed to protect (*e. g.,* transforming or
reducing an article to a different state or thing), then the
claim satisfies the requirements of § 101. Because we do not
view respondents' claims as an attempt to patent a mathe-
matical formula, but rather to be drawn to an industrial proc-

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[14] Arguably, the claims in *Flook* did more than present a mathematical
formula. The claims also solved the calculation in order to produce a new
number or "alarm limit" and then replaced the old number with the num-
ber newly produced. The claims covered all uses of the formula in proc-
esses "comprising the catalytic chemical conversion of hydrocarbons."
There are numerous such processes in the petrochemical and oil refinery
industries and the claims therefore covered a broad range of potential uses.
437 U. S., at 586. The claims, however, did not cover every conceivable
application of the formula. We rejected in *Flook* the argument that be-
cause all possible uses of the mathematical formula were not pre-empted,
the claim should be eligible for patent protection. Our reasoning in *Flook*
is in no way inconsistent with our reasoning here. A mathematical for-
mula does not suddenly become patentable subject matter simply by hav-
ing the applicant acquiesce to limiting the reach of the patent for the
formula to a particular technological use. A mathematical formula in the
abstract is nonstatutory subject matter regardless of whether the patent is
intended to cover all uses of the formula or only limited uses. Similarly, a
mathematical formula does not become patentable subject matter merely
by including in the claim for the formula token postsolution activity such
as the type claimed in *Flook*. We were careful to note in *Flook* that the
patent application did not purport to explain how the variables used in
the formula were to be selected, nor did the application contain any dis-
closure relating to chemical processes at work or the means of setting off
an alarm or adjusting the alarm limit. *Ibid.* All the application pro-
vided was a "formula for computing an updated alarm limit." *Ibid.*

ess for the molding of rubber products, we affirm the judgment of the Court of Customs and Patent Appeals.[18]

It is so ordered.

JUSTICE STEVENS, with whom JUSTICE BRENNAN, JUSTICE MARSHALL, and JUSTICE BLACKMUN join, dissenting.

The starting point in the proper adjudication of patent litigation is an understanding of what the inventor claims

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[18] The dissent's analysis rises and falls on its characterization of respondents' claims as presenting nothing more than "an improved method of calculating the time that the mold should remain closed during the curing process." *Post,* at 206–207. The dissent states that respondents claim only to have developed "a new method of programming a digital computer in order to calculate—promptly and repeatedly—the correct curing time in a familiar process." *Post,* at 213. Respondents' claims, however, are not limited to the isolated step of "programming a digital computer." Rather, respondents' claims describe a process of curing rubber beginning with the loading of the mold and ending with the opening of the press and the production of a synthetic rubber product that has been perfectly cured—a result heretofore unknown in the art. See n. 5, *supra.* The fact that one or more of the steps in respondents' process may not, in isolation, be novel or independently eligible for patent protection is irrelevant to the question of whether the claims as a whole recite subject matter *eligible* for patent protection under § 101. As we explained when discussing machine patents in *Deepsouth Packing Co.* v. *Laitram Corp.,* 406 U. S. 518 (1972):

"The patents were warranted not by the novelty of their elements but by the novelty of the combination they represented. Invention was recognized because Laitram's assignors combined ordinary elements in an extraordinary way—a novel union of old means was designed to achieve new ends. Thus, for both inventions 'the whole in some way exceed[ed] the sum of its parts.' *Great A. & P. Tea Co.* v. *Supermarket Equipment Corp.,* 340 U. S. 147, 152 (1950)." *Id.,* at 521–522 (footnote omitted).

In order for the dissent to reach its conclusion it is necessary for it to read out of respondents' patent application all the steps in the claimed process which it determined were not novel or "inventive." That is not the purpose of the § 101 inquiry and conflicts with the proposition recited above that a claimed invention may be entitled to patent protection even though some or all of its elements are not "novel."

to have discovered. The Court's decision in this case rests on a misreading of the Diehr and Lutton patent application. Moreover, the Court has compounded its error by ignoring the critical distinction between the character of the subject matter that the inventor claims to be novel—the § 101 issue—and the question whether that subject matter is in fact novel—the § 102 issue.

I

Before discussing the major flaws in the Court's opinion, a word of history may be helpful. As the Court recognized in *Parker* v. *Flook*, 437 U. S. 584, 595 (1978), the computer industry is relatively young. Although computer technology seems commonplace today, the first digital computer capable of utilizing stored programs was developed less than 30 years ago.[1] Patent law developments in response to this new technology are of even more recent vintage. The subject of legal protection for computer programs did not begin to receive serious consideration until over a decade after completion of the first programmable digital computer.[2] It was 1968 be-

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[1] ENIAC, the first general purpose electronic digital computer, was built in 1946. Unlike modern computers, this machine was externally programmed; its circuitry had to be manually rewired each time it was used to perform a new task. See Gemignani, Legal Protection for Computer Software: The View From '79, 7 Rutgers J. Computers, Tech. & L. 269, 270 (1980). In 1952, a group of scientists at the Institute for Advanced Study completed MANIAC I, the first digital computer capable of operating upon stored programs, as opposed to hard-wired circuitry. See Ulam, Computers, 211 Scientific American 203 (1964).

[2] The subject received some scholarly attention prior to 1964. See, *e. g.*, Seidel, Antitrust. Patent and Copyright Law Implications of Computer Technology, 44 J. Pat. Off. Soc. 116 (1962); Comment, The Patentability of Computer Programs, 38 N. Y. U. L. Rev. 891 (1963). In 1964, the Copyright Office began registering computer programs. See 11 Copyright Soc. Bull. 361 (1964); Davis, Computer Programs and Subject Matter Patentability, 6 Rutgers J. Computers, Tech. & L. 1, 5 (1977). Also in 1964, the Patent Office Board of Appeals issued what appears to be the first published opinion concerning the patentability of a computer-related invention. See *Ex parte King*, 146 USPQ 590.

fore the federal courts squarely addressed the subject,[3] and 1972 before this Court announced its first decision in the area.[4]

Prior to 1968, well-established principles of patent law probably would have prevented the issuance of a valid patent on almost any conceivable computer program. Under the "mental steps" doctrine, processes involving mental operations were considered unpatentable. See, e. g., In re Heritage, 32 C. C. P. A. (Pat.) 1170, 1173–1177, 150 F. 2d 554, 556–558 (1945); In re Shao Wen Yuan, 38 C. C. P. A. (Pat.) 967, 972–976, 188 F. 2d 377, 380–383 (1951). The mental-steps doctrine was based upon the familiar principle that a scientific concept or mere idea cannot be the subject of a valid patent. See In re Bolongaro, 20 C. C. P. A. (Pat.) 845, 846–847, 62 F. 2d 1059, 1060 (1933).[5] The doctrine was regularly invoked to deny patents to inventions consisting primarily of mathematical formulae or methods of computation.[6] It was also applied against patent claims in which a mental operation or mathematical computation was the sole novel element or inventive contribution; it was clear that patentability

[3] In re Prater, 56 C. C. P. A. (Pat.) 1360, 415 F. 2d 1378 (1968), modified on rehearing, 56 C. C. P. A. (Pat.) 1381, 415 F. 2d 1393 (1969), is generally identified as the first significant judicial decision to consider the subject-matter patentability of computer program-related inventions. The Court of Customs and Patent Appeals earlier decided In re Naquin, 55 C. C. P. A. (Pat.) 1428, 398 F. 2d 863 (1968), in which it rejected a challenge to an application for a patent on a program-related invention on grounds of inadequate disclosure under § 112.

[4] See Gottschalk v. Benson, 409 U. S. 63 (1972).

[5] See also Novick & Wallenstein, The Algorithm and Computer Software Patentability: A Scientific View of a Legal Problem, 7 Rutgers J. Computers, Tech. & L. 313, 316–317 (1980).

[6] See, e. g., Don Lee, Inc. v. Walker, 61 F. 2d 58, 67 (CA9 1932); In re Bolongaro, 20 C. C. P. A. (Pat.) 845, 846–847, 62 F. 2d 1059, 1060 (1933); In re Shao Wen Yuan, 38 C. C. P. A. (Pat.) 967, 969–972, 188 F. 2d 377, 379–380 (1951); Lyman v. Ladd, 120 U. S. App. D. C. 388, 389, 347 F. 2d 482, 483 (1965).

could not be predicated upon a mental step.[7] Under the "function of a machine" doctrine, a process which amounted to nothing more than a description of the function of a machine was unpatentable. This doctrine had its origin in several 19th-century decisions of this Court,[8] and it had been consistently followed thereafter by the lower federal courts.[9]

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[7] See, e. g., In re Cooper, 30 C. C. P. A. (Pat.) 946, 949, 134 F. 2d 630, 632 (1943); Halliburton Oil Well Cementing Co. v. Walker, 146 F. 2d 817, 821, 823 (CA9 1944), rev'd on other grounds, 329 U. S. 1 (1946); In re Heritage, 32 C. C. P. A. (Pat.) 1170, 1173–1177, 150 F. 2d 554, 556–558 (1945); In re Abrams, 38 C. C. P. A. (Pat.) 945, 950–953, 188 F. 2d 165, 168–170 (1951); In re Shao Wen Yuan, supra, at 975–976, 188 F. 2d, at 383; In re Lundberg, 39 C. C. P. A. (Pat.) 971, 975, 197 F. 2d 336, 339 (1952); In re Venner, 46 C. C. P. A. (Pat.) 754, 758–759, 262 F. 2d 91, 95 (1958).

[8] The "function of a machine" doctrine is generally traced to Corning v. Burden, 15 How. 252, 268 (1854), in which the Court stated: "[I]t is well settled that a man cannot have a patent for the function or abstract effect of a machine, but only for the machine which produces it." The doctrine was subsequently reaffirmed on several occasions. See, e. g., Risdon Iron & Locomotive Works v. Medart, 158 U. S. 68, 78–79, 84 (1895); Westinghouse v. Boyden Power Brake Co., 170 U. S. 537, 554–557 (1898); Busch v. Jones, 184 U. S. 598, 607 (1902); Expanded Metal Co. v. Bradford, 214 U. S. 366, 383 (1909).

[9] See, e. g., In re Weston, 17 App. D. C. 431, 436–442 (1901); Chisholm-Ryder Co. v. Buck, 65 F. 2d 735, 736 (CA4 1933); In re Ernst, 21 C. C. P. A. (Pat.) 1235, 1238–1240, 71 F. 2d 169, 171–172 (1934); In re McCurdy, 22 C. C. P. A. (Pat.) 1140, 1142–1145, 76 F. 2d 400, 402–403, (1935); In re Parker, 23 C. C. P. A. (Pat.) 721, 722–725, 79 F. 2d 908, 909–910 (1935); Black-Clawson Co. v. Centrifugal Engineering & Patents Corp., 83 F. 2d 116, 119–120 (CA6), cert. denied, 299 U. S. 554 (1936); In re Wadman, 25 C. C. P. A. (Pat.) 936, 943–944, 94 F. 2d 993, 998 (1938); In re Mead, 29 C. C. P. A. (Pat.) 1001, 1004, 127 F. 2d 302, 304 (1942), In re Solakian, 33 C. C. P. A. (Pat.) 1054, 1059, 155 F. 2d 404, 407 (1946); In re Middleton, 35 C. C. P. A. (Pat.) 1166, 1167–1168, 167 F. 2d 1012, 1013–1014 (1948); In re Nichols, 36 C. C. P. A. (Pat.) 759, 762–763, 171 F. 2d 300, 302–303 (1948); In re Ashbaugh, 36 C. C. P. A. (Pat.) 902, 904–905, 173 F. 2d 273, 274–275 (1949); In re Horvath, 41 C. C. P. A. (Pat.) 844, 849–851, 211 F. 2d 604, 607–608 (1954); In re Gartner, 42 C. C. P. A. (Pat.) 1022, 1025–1026, 223 F. 2d 502, 504 (1955).

Finally, the definition of "process" announced by this Court in *Cochrane v. Deener*, 94 U. S. 780, 787–788 (1877), seemed to indicate that a patentable process must cause a physical transformation in the materials to which the process is applied. See *ante*, at 182–184.

Concern with the patent system's ability to deal with rapidly changing technology in the computer and other fields led to the formation in 1965 of the President's Commission on the Patent System. After studying the question of computer program patentability, the Commission recommended that computer programs be expressly excluded from the coverage of the patent laws; this recommendation was based primarily upon the Patent Office's inability to deal with the administrative burden of examining program applications.[10] At approximately the time that the Commission issued its report, the Patent Office published notice of its intention to prescribe guidelines for the examination of applications for patents on computer programs. See 829 Off. Gaz. Pat. Off. 865 (Aug. 16, 1966). Under the proposed guidelines, a computer program, whether claimed as an apparatus or as a process, was unpatentable.[11] The Patent Office indicated, how-

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[10] The Commission's report contained the following evaluation of the current state of the law with respect to computer program patentability:

"Uncertainty now exists as to whether the statute permits a valid patent to be granted on programs. Direct attempts to patent programs have been rejected on the ground of nonstatutory subject matter. Indirect attempts to obtain patents and avoid the rejection, by drafting claims as a process, or a machine or components thereof programmed in a given manner, rather than as a program itself, have confused the issue further and should not be permitted." Report of the President's Commission on the Patent System, "To Promote the Progress of . . . Useful Arts" in an Age of Exploding Technology 14 (1966).

[11] The Patent Office guidelines were based primarily upon the mental-steps doctrine and the *Cochrane v. Deener*, 94 U S. 780 (1877), definition of "process." See 829 Off. Gaz. Pat. Off. 865 (Aug. 16, 1966); 33 Fed. Reg. 15609 (1968).

ever, that a programmed computer could be a component of a patentable process if combined with unobvious elements to produce a physical result. The Patent Office formally adopted the guidelines in 1968. See 33 Fed. Reg. 15609 (1968).

The new guidelines were to have a short life. Beginning with two decisions in 1968, a dramatic change in the law as understood by the Court of Customs and Patent Appeals took place. By repudiating the well-settled "function of a machine" and "mental steps" doctrines, that court reinterpreted § 101 of the Patent Code to enlarge drastically the categories of patentable subject matter. This reinterpretation would lead to the conclusion that computer programs were within the categories of inventions to which Congress intended to extend patent protection.

In *In re Tarczy-Hornoch*, 55 C. C. P. A. (Pat.) 1441, 397 F. 2d 856 (1968), a divided Court of Customs and Patent Appeals overruled the line of cases developing and applying the "function of a machine" doctrine. The majority acknowledged that the doctrine had originated with decisions of this Court and that the lower federal courts, including the Court of Customs and Patent Appeals, had consistently adhered to it during the preceding 70 years. Nonetheless, the court concluded that the doctrine rested on a misinterpretation of the precedents and that it was contrary to "the basic purposes of the patent system and productive of a range of undesirable results from the harshly inequitable to the silly." *Id.*, at 1454, 397 F. 2d, at 867.[12] Shortly thereafter, a similar

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[12] Judge Kirkpatrick, joined by Chief Judge Worley, wrote a vigorous dissent objecting to the majority's decision to abandon "a rule which is about as solidly established as any rule of the patent law." 55 C. C. P. A. (Pat.), at 1457, 397 F. 2d, at 868. Unlike the majority, the dissenting judges did not consider the doctrine inequitable or silly, and they observed that it had functioned in a satisfactory manner in the past. *Id.*, at 1457–1458, 397 F. 2d, at 869. In addition, they considered the doctrine to be so well established that it had been adopted by implication in the Patent Act of 1952. *Id.*, at 1458, 397 F. 2d, at 869.

fate befell the "mental steps" doctrine. In *In re Prater*, 56 C. C. P. A. (Pat.) 1360, 415 F. 2d 1378 (1968), modified on rehearing, 56 C. C. A. P. (Pat.) 1381, 415 F. 2d 1393 (1969), the court found that the precedents on which that doctrine was based either were poorly reasoned or had been misinterpreted over the years. 56 C. C. P. A. (Pat.), at 1366–1372, 415 F. 2d, at 1382–1387. The court concluded that the fact that a process may be performed mentally should not foreclose patentability if the claims reveal that the process also may be performed without mental operations. *Id.*, at 1374–1375, 415 F. 2d, at 1389.[13] This aspect of the original *Prater* opinion was substantially undisturbed by the opinion issued after rehearing. However, the second *Prater* opinion clearly indicated that patent claims broad enough to encompass the operation of a programmed computer would not be rejected for lack of patentable subject matter. 56 C. C. P. A. (Pat.), at 1394, n. 29, 415 F. 2d, at 1403, n. 29.[14]

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[13] In *Prater*, the patent application claimed an improved method for processing spectrographic data. The method analyzed conventionally obtained data by using well-known equations. The inventors had discovered a particular mathematical characteristic of the equations which enabled them to select the specific subset of equations that would yield optimum results. The application disclosed an analog computer as the preferred embodiment of the invention, but indicated that a programmed digital computer could also be used. 56 C. C. P. A. (Pat.), at 1361–1363, 415 F. 2d, at 1379–1380. The Patent Office had rejected the process claims on a mental-steps theory because the only novel aspect of the claimed method was the discovery of an unpatentable mathematical principle. The apparatus claim was rejected essentially because, when the mathematical principle was assumed to be within the prior art, the claim disclosed no invention entitled to patent protection. *Id.*, at 1364–1365, 1375, 415 F. 2d, at 1381, 1399.

[14] It is interesting to note that the Court of Customs and Patent Appeals in the second *Prater* opinion expressly rejected the Patent Office's procedure for analyzing the apparatus claim pursuant to which the mathematical principle was treated as though it were within the prior art. 56 C. C. P. A. (Pat.), at 1397, 415 F. 2d, at 1405–1406. This precise procedure, of course, was later employed by this Court in *Parker* v. *Flook*, 437 U. S. 584 (1978).

The Court of Customs and Patent Appeals soon replaced the overruled doctrines with more expansive principles formulated with computer technology in mind. In *In re Bernhart*, 57 C. C. P. A. (Pat.) 737, 417 F. 2d 1395 (1969), the court reaffirmed *Prater*, and indicated that all that remained of the mental-steps doctrine was a prohibition on the granting of a patent that would confer a monopoly on all uses of a scientific principle or mathematical equation. *Id.*, at 743, 417 F. 2d, at 1399. The court also announced that a computer programmed with a new and unobvious program was physically different from the same computer without that program; the programmed computer was a new machine or at least a new improvement over the unprogrammed computer. *Id.*, at 744, 417 F. 2d, at 1400. Therefore, patent protection could be obtained for new computer programs if the patent claims were drafted in apparatus form.

The Court of Customs and Patent Appeals turned its attention to process claims encompassing computer programs in *In re Musgrave*, 57 C. C. P. A. (Pat.) 1352, 431 F. 2d 882 (1970). In that case, the court emphasized the fact that *Prater* had done away with the mental-steps doctrine; in particular, the court rejected the Patent Office's continued reliance upon the "point of novelty" approach to claim analysis. *Id.*, at 1362, 431 F. 2d, at 889.[15] The court also announced a new standard for evaluating process claims under § 101: any sequence of operational steps was a patentable process under § 101 as long as it was within the "technological arts." *Id.*, at 1366–1367, 431 F. 2d, at 893. This standard effectively disposed of any vestiges of the mental-steps doctrine remain-

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[15] Under the "point of novelty" approach, if the novelty or advancement in the art claimed by the inventor resided solely in a step of the process embodying a mental operation or other unpatentable element, the claim was rejected under § 101 as being directed to nonstatutory subject matter. See Blumenthal & Riter, Statutory or Non-Statutory?: An Analysis of the Patentability of Computer Related Inventions, 62 J. Pat. Off. Soc. 454, 457, 461, 470 (1980).

ing after *Prater* and *Bernhart*.[16] The "technological arts" standard was refined in *In re Benson*, 58 C. C. P. A. (Pat.) 1134, 441 F. 2d 682 (1971), in which the court held that computers, regardless of the uses to which they are put, are within the technological arts for purposes of § 101. *Id.*, at 1142, 441 F. 2d, at 688.

In re Benson, of course, was reversed by this Court in *Gottschalk* v. *Benson*, 409 U. S. 63 (1972).[17] Justice Douglas' opinion for a unanimous Court made no reference to the lower court's rejection of the mental-steps doctrine or to the new technological-arts standard.[18] Rather, the Court clearly held that new mathematical procedures that can be conducted in old computers, like mental processes and abstract intellectual concepts, see *id.*, at 67, are not patentable processes within the meaning of § 101.

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[16] The author of the second *Prater* opinion, Judge Baldwin, disagreed with the *Musgrave* "technological arts" standard for process claims. He described that standard as "a major and radical shift in this area of the law." 57 C. C. P. A. (Pat.), at 1367, 431 F. 2d, at 893–894. As Judge Baldwin read the majority opinion, claims drawn solely to purely mental processes were now entitled to patent protection. *Id.*, at 1369, 431 F. 2d, at 895–896. Judge Baldwin's understanding of *Musgrave* seems to have been confirmed in *In re Foster*, 58 C. C. P. A. (Pat.) 1001, 1004–1005, 438 F. 2d 1011, 1014–1015 (1971).

[17] In the interval between the two *Benson* decisions, the Court of Customs and Patent Appeals decided several cases in which it addressed the patentability of computer-related inventions. In *In re McIlroy*, 58 C. C. P. A. (Pat.) 1249, 442 F. 2d 1397 (1971), and *In re Waldbaum*, 59 C. C. P. A. (Pat.) 940, 457 F. 2d 997 (1972), the court relied primarily upon *Musgrave* and *Benson*. In *In re Ghiron*, 58 C. C. P. A. (Pat.) 1207, 442 F. 2d 985 (1971), the court reaffirmed *Tarczy-Hornoch*'s rejection of the "function of a machine" doctrine.

[18] Although the Court did not discuss the mental-steps doctrine in *Benson*, some commentators have suggested that the Court implicitly relied upon the doctrine in that case. See, *e. g.*, Davis, *supra* n. 2, at 14, and n. 92. Other commentators have observed that the Court's analysis in *Benson* was entirely consistent with the mental-steps doctrine. See, *e. g.*, Comment, Computer Program Classification: A Limitation on Program Patentability as a Process, 53 Or. L. Rev. 501, 517–518, n. 132 (1974).

The Court of Customs and Patent Appeals had its first opportunity to interpret *Benson* in *In re Christensen*, 478 F. 2d 1392 (1973). In *Christensen*, the claimed invention was a method in which the only novel element was a mathematical formula. The court resurrected the point-of-novelty approach abandoned in *Musgrave* and held that a process claim in which the point of novelty was a mathematical equation to be solved as the final step of the process did not define patentable subject matter after *Benson*. 478 F. 2d, at 1394. Accordingly, the court affirmed the Patent Office Board of Appeals' rejection of the claims under § 101.

The Court of Customs and Patent Appeals in subsequent cases began to narrow its interpretation of *Benson*. In *In re Johnston*, 502 F. 2d 765 (1974), the court held that a record-keeping machine system which comprised a programmed digital computer was patentable subject matter under § 101. *Id.*, at 771. The majority dismissed *Benson* with the observation that *Benson* involved only process, not apparatus, claims. 502 F. 2d, at 771. Judge Rich dissented, arguing that to limit *Benson* only to process claims would make patentability turn upon the form in which a program invention was claimed. 502 F. 2d, at 773-774.[19] The court again construed *Benson* as limited only to process claims in *In re Noll*, 545 F. 2d 141 (1976), cert. denied, 434 U. S. 875 (1977); apparatus claims were governed by the court's pre-*Benson* conclusion that a programmed computer was structurally different from the same computer without that particular program. 545 F. 2d, at 148. In dissent, Judge Lane, joined by Judge Rich, argued that *Benson* should be read as a general proscription of the patenting of computer programs regardless of the form of the claims. 545 F. 2d, at 151-152. Judge Lane's interpretation of *Benson* was rejected by the majority

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[19] The decision of the Court of Customs and Patent Appeals was reversed by this Court on other grounds in *Dann* v. *Johnston*, 425 U. S. 219 (1976).

in *In re Chatfield*, 545 F. 2d 152 (1976), cert. denied, 434
U. S. 875 (1977), decided on the same day as *Noll*. In that
case, the court construed *Benson* to preclude the patenting
of program inventions claimed as processes only where the
claims would pre-empt all uses of an algorithm or mathe-
matical formula. 545 F. 2d, at 156, 158–159.[20] The dissent-
ing judges argued, as they had in *Noll*, that *Benson* held that
programs for general-purpose digital computers are not pat-
entable subject matter. 545 F. 2d, at 161.

Following *Noll* and *Chatfield*, the Court of Customs and
Patent Appeals consistently interpreted *Benson* to preclude
the patenting of a program-related process invention only
when the claims, if allowed, would wholly pre-empt the
algorithm itself. One of the cases adopting this view was
In re Flook, 559 F. 2d 21 (1977),[21] which was reversed in
Parker v. *Flook*, 437 U. S. 584 (1978). Before this Court
decided *Flook*, however, the lower court developed a two-step
procedure for analyzing program-related inventions in light
of *Benson*. In *In re Freeman*, 573 F. 2d 1237 (1978), the
court held that such inventions must first be examined to de-
termine whether a mathematical algorithm is directly or in-
directly claimed; if an algorithm is recited, the court must
then determine whether the claim would wholly pre-empt
that algorithm. Only if a claim satisfied both inquiries was
Benson considered applicable. 573 F. 2d, at 1245. See also
In re Toma, 575 F. 2d 872, 877 (CCPA 1978).

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[20] In addition to interpreting *Benson*, the majority also maintained that
Christensen, despite its point-of-novelty language, had not signalled a
return to that form of claim analysis. 545 F. 2d, at 158. The court
would reaffirm this proposition consistently thereafter. See, *e. g., In re de
Castelet*, 562 F. 2d 1236, 1240 (1977); *In re Richman*, 563 F. 2d 1026,
1029–1030 (1977); *In re Freeman*, 573 F. 2d 1237, 1243–1244 (1978);
In re Toma, 575 F. 2d 872, 876 (1978); *In re Walter*, 618 F. 2d 758,
766–767 (1980).

[21] See also *In re Deutsch*, 553 F. 2d 689, 692–693 (CCPA 1977); *In re
Waldbaum*, 559 F. 2d 611, 616–617 (CCPA 1977); *In re de Castelet*,
supra, at 1243–1245.

In *Flook*, this Court clarified *Benson* in three significant respects. First, *Flook* held that the *Benson* rule of unpatentable subject matter was not limited, as the lower court believed, to claims which wholly pre-empted an algorithm or amounted to a patent on the algorithm itself. 437 U. S., at 589–590. Second, the Court made it clear that an improved method of calculation, even when employed as part of a physical process, is not patentable subject matter under § 101. *Id.*, at 595, n. 18. Finally, the Court explained the correct procedure for analyzing a patent claim employing a mathematical algorithm. Under this procedure, the algorithm is treated for § 101 purposes as though it were a familiar part of the prior art; the claim is then examined to determine whether it discloses "some other inventive concept." *Id.*, at 591–595.[22]

Although the Court of Customs and Patent Appeals in several post-*Flook* decisions held that program-related inventions were not patentable subject matter under § 101, see, e. g., *In re Sarkar*, 588 F. 2d 1330 (1978); *In re Gelnovatch*, 595 F. 2d 32 (1979), in general *Flook* was not enthusiastically received by that court. In *In re Bergy*, 596 F. 2d 952 (1979), the majority engaged in an extensive critique of *Flook*, concluding that this Court had erroneously commingled "distinct statutory provisions which are conceptually unrelated." 596 F. 2d, at 959.[23] In subsequent cases, the court construed

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[22] This form of claim analysis did not originate with *Flook*. Rather, the Court derived it from the landmark decision of *O'Reilly* v. *Morse*, 15 How. 62, 115 (1854). In addition, this analysis is functionally the same as the point-of-novelty analysis used in conjunction with the mental-steps doctrine. In fact, the Patent Office in the past occasionally phrased its mental-steps rejections in essentially the terms later employed in *Flook*. See nn. 13–15, *supra*. See generally Comment, 35 U. S. C. 101 Claim Analysis—The Point of Novelty Approach, 62 J. Pat. Off. Soc. 521 (1980).

[23] The Court of Customs and Patent Appeals suggested that the cause of this Court's error was the argument presented by the Solicitor General in *Flook*. According to the majority, the Solicitor General's briefs "badly, and with a seeming sense of purpose" confused the statutory requirements.

Flook as resting on nothing more than the way in which the patent claims had been drafted, and it expressly declined to use the method of claim analysis spelled out in that decision. The Court of Customs and Patent Appeals has taken the position that, if an application is drafted in a way that discloses an entire process as novel, it defines patentable subject matter even if the only novel element that the inventor claims to have discovered is a new computer program.[24] The court interpreted *Flook* in this manner in its opinion in this case. See *In re Diehr*, 602 F. 2d 982, 986–989 (1979). In my judgment, this reading of *Flook*—although entirely consistent with the lower court's expansive approach to § 101 during the past 12 years—trivializes the holding in *Flook*, the principle that underlies *Benson*, and the settled line of authority reviewed in those opinions.

II

As I stated at the outset, the starting point in the proper adjudication of patent litigation is an understanding of what the inventor claims to have discovered. Indeed, the outcome of such litigation is often determined by the judge's understanding of the patent application. This is such a case.

In the first sentence of its opinion, the Court states the question presented as "whether a process for curing synthetic rubber . . . is patentable subject matter." *Ante*, at 177. Of course, that question was effectively answered many years ago when Charles Goodyear obtained his patent on the vulcanization process.[25] The patent application filed by Diehr

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596 F. 2d, at 962. The court went on to describe part of the Solicitor General's argument in *Flook* as "subversive nonsense." 596 F. 2d, at 963.

[24] See, *e. g.*, *In re Johnson*, 589 F. 2d 1070 (1978); *In re Phillips*, 608 F. 2d 879 (1979); *In re Sherwood*, 613 F. 2d 809 (1980), cert. pending, No. 79–1941.

[25] In an opinion written over a century ago, the Court noted:

"A manufacturing process is clearly an art, within the meaning of the law. Goodyear's patent was for a process, namely, the process of vulcanizing

and Lutton, however, teaches nothing about the chemistry of the synthetic rubber-curing process, nothing about the raw materials to be used in curing synthetic rubber, nothing about the equipment to be used in the process, and nothing about the significance or effect of any process variable such as temperature, curing time, particular compositions of material, or mold configurations. In short, Diehr and Lutton do not claim to have discovered anything new about the process for curing synthetic rubber.

As the Court reads the claims in the Diehr and Lutton patent application, the inventors' discovery is a method of constantly measuring the actual temperature inside a rubber molding press.[24] As I read the claims, their discovery is an

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india-rubber by subjecting it to a high degree of heat when mixed with sulphur and a mineral salt.

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"The mixing of certain substances together, or the heating of a substance to a certain temperature, is a process." *Tilghman* v. *Proctor,* 102 U. S. 707, 722, 728 (1881).

See also *Corning* v. *Burden,* 15 How. 252, 267 (1854). Modern rubber curing methods apparently still are based in substantial part upon the concept discovered by Goodyear:

"Since the day 120 years ago when Goodyear first heated a mixture of rubber and sulphur on a domestic stove and so discovered vulcanisation, this action of heat and sulphur has remained the standard method of converting crude rubber, with all its limitations, into a commercially usable product, giving it the qualities of resistance to heat and cold in addition to considerable mechanical strength.

"Goodyear also conjured up the word 'cure' for vulcanisation, and this has become the recognised term in production circles." Mernagh, Practical Vulcanisation, in The Applied Science of Rubber 1053 (W. Naunton ed. 1961).

See generally Kimmich, Making Rubber Products for Engineering Uses, in Engineering Uses of Rubber 18, 28–34 (A. McPherson & A. Klemin eds. 1956)

[24] "Respondents characterise their contribution to the art to reside in the process of constantly measuring the actual temperature inside the mold." See *ante,* at 178.

improved method of calculating the time that the mold
should remain closed during the curing process.[27] If the
Court's reading of the claims were correct, I would agree that
they disclose patentable subject matter. On the other hand,
if the Court accepted my reading, I feel confident that the
case would be decided differently.

There are three reasons why I cannot accept the Court's
conclusion that Diehr and Lutton claim to have discovered
a new method of constantly measuring the temperature in-
side a mold. First, there is not a word in the patent applica-
tion that suggests that there is anything unusual about the
temperature-reading devices used in this process—or indeed
that any particular species of temperature-reading device
should be used in it.[28] Second, since devices for constantly

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[27] Claim 1 is quoted in full in n. 5 of the Court's opinion, *ante*, at 179.
It describes a "method of operating a rubber-molding press for precision
molded compounds with the aid of a digital computer." As the Court of
Customs and Patent Appeals noted, the improvement claimed in the appli-
cation consists of "opening the mold at precisely the correct time rather
than at a time which has been determined by approximation or guesswork."
In re Diehr, 602 F. 2d 982, 988 (1979).

[28] In the portion of the patent application entitled "Abstract of the
Disclosure," the following reference to monitoring the temperature is
found:

"An interval timer starts running from the time of mold closure, and the
temperature within the mold cavity is measured often, typically every ten
seconds. The temperature is fed to a computer . . . ." App. to Pet. for
Cert. 38a.

In the portion of the application entitled "Background of the Invention,"
the following statement is found:

"By accurate and constant calculation and recalculation of the correct
mold time under the temperatures actually present in the mold, the ma-
terial can be cured accurately and can be relied upon to produce very
few rejections, perhaps completely eliminating all rejections due to faulty
mold cure." *Id.*, at 41a.

And, in the "Summary of the Invention," this statement appears:

"A surveillance system is maintained over the mold to determine the
actual mold temperature substantially continuously, for example, every

measuring actual temperatures—on a back porch, for example—have been familiar articles for quite some time, I find it difficult to believe that a patent application filed in 1975 was premised on the notion that a "process of constantly measuring the actual temperature" had just been discovered. Finally, the Patent and Trademark Office Board of Appeals expressly found that "the only difference between the conventional methods of operating a molding press and that claimed in [the] application rests in those steps of the claims which relate to the calculation incident to the solution of the mathematical problem or formula used to control the mold heater and the automatic opening of the press."[29] This finding was not disturbed by the Court of Customs and Patent Appeals and is clearly correct.

A fair reading of the entire patent application, as well as the specific claims, makes it perfectly clear that what Diehr and Lutton claim to have discovered is a method of using a digital computer to determine the amount of time that a rubber molding press should remain closed during the synthetic rubber-curing process. There is no suggestion that there is anything novel in the instrumentation of the mold, in actuating a timer when the press is closed, or in automatically opening the press when the computed time expires.[30] Nor does the

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ten seconds, and to feed that information to the computer along with the pertinent stored data and along with the elapsed time information." *Ibid.* Finally, in a description of a simple hypothetical application using the invention described in Claim 1, this is the reference to the temperature-reading device:

"Thermocouples, or other temperature-detecting devices, located directly within the mold cavity may read the temperature at the surface where the molding compound touches the mold, so that it actually gets the temperature of the material at that surface." *Id.*, at 45a.

[29] *Id.*, at 24a.

[30] These elements of the rubber-curing process apparently have been well known for years The following description of the vulcanization process appears in a text published in 1961:

"Vulcanization is too important an operation to be left to human control, however experienced and conscientious. Instrumentation makes controlled

application suggest that Diehr and Lutton have discovered anything about the temperatures in the mold or the amount of curing time that will produce the best cure. What they claim to have discovered, in essence, is a method of updating the original estimated curing time by repetitively recalculating that time pursuant to a well-known mathematical formula in response to variations in temperature within the mold. Their method of updating the curing time calculation is strikingly reminiscent of the method of updating alarm limits that Dale Flook sought to patent.

Parker v. *Flook,* 437 U. S. 584 (1978), involved the use of a digital computer in connection with a catalytic conversion process. During the conversion process, variables such as temperature, pressure, and flow rates were constantly monitored and fed into the computer; in this case, temperature in the mold is the variable that is monitored and fed into the computer. In *Flook,* the digital computer repetitively recalculated the "alarm limit"—a number that might signal the need to terminate or modify the catalytic conversion process; in this case, the digital computer repetitively recalculates the correct curing time—a number that signals the time when the synthetic rubber molding press should open.

The essence of the claimed discovery in both cases was an algorithm that could be programmed on a digital computer.[31]

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cure possible, and in consequence instrument engineering is a highly important function in the modern rubber factory, skilled attention being necessary, not only in the maintenance of the instruments but also in their siting. There are instruments available which will indicate, record or control all the services involved in vulcanisation, including time, temperature and pressure, and are capable of setting in motion such operations as the opening and closing of moulds and, in general, will control any process variable which is capable of being converted into an electric charge or pneumatic or hydraulic pressure impulse." Mernagh, *supra* n. 25, at 1091–1092.

[31] Commentators critical of the *Flook* decision have noted the essential similarity of the two inventions:

"The *Diehr* invention improved the control system by continually re-

In *Flook,* the algorithm made use of multiple process varia-
bles; in this case, it makes use of only one. In *Flook,* the
algorithm was expressed in a newly developed mathematical
formula; in this case, the algorithm makes use of a well-
known mathematical formula. Manifestly, neither of these
differences can explain today's holding.[32] What I believe

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measuring the temperature and recalculating the proper cure time. The
computer would simultaneously keep track of the elapsed time. When
the elapsed time equalled the proper cure time, the rubber would be re-
leased automatically from the mold.

"The facts are difficult to distinguish from those in *Flook.* Both proc-
esses involved (1) an initial calculation, (2) continual remeasurement and
recalculation, and (3) some control use of the value obtained from the
calculation." Novick & Wallenstein, *supra* n. 5, at 326 (footnotes
omitted).

[32] Indeed, the most significant distinction between the invention at issue
in *Flook* and that at issue in this case lies not in the characteristics of
the inventions themselves, but rather in the drafting of the claims. After
noting that "[t]he Diehr claims are reminiscent of the claims in *Flook,*"
Blumenthal & Riter, *supra* n. 15, at 502–503 (footnote omitted), the
authors of a recent article on the subject observe that the Court of
Customs and Patent Appeals' analysis in this case "lends itself to an
interesting exercise in claim drafting." *Id.,* at 505. To illustrate their
point, the authors redrafted the Diehr and Lutton claims into the format
employed in the *Flook* application:

"An improved method of calculating the cure time of a rubber molding
process utilizing a digital computer comprising the steps of:

"a. inputting into said computer input values including

"1. natural logarithm conversion data ([l]n),

"2. an activation energy constant (C) unique to each batch of rubber
being molded,

"3. a constant (X) dependent upon the geometry of the particular mold
of the press, and

"4. continuous temperature values (Z) of the mold during molding;

"b. operating said computer for

"1. counting the elapsed cure time,

"2. calculating the cure time from the input values using the Arrhenius
equation $[l]n\ V = CZ + X$, where V is the total cure time, and

does explain today's holding is a misunderstanding of the
applicants' claimed invention and a failure to recognize the
critical difference between the "discovery" requirement in
§ 101 and the "novelty" requirement in § 102.[33]

III

Tho Court misapplies *Parker* v. *Flook* because, like the
Court of Customs and Patent Appeals, it fails to understand
or completely disregards the distinction between the subject
matter of what the inventor *claims* to have discovered—the
§ 101 issue—and the question whether that claimed discovery
is in fact novel—the § 102 issue.[34] If there is not even a

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"c. providing output signals from said computer when said calculated
cure time is equal to said elapsed cure time." *Ibid.*

The authors correctly conclude that even the lower court probably would
have found that this claim was drawn to unpatentable subject matter
under § 101. *Id.,* at 505-506.

[33] In addition to confusing the requirements of §§ 101 and 102, the Court
also misapprehends the record in this case when it suggests that the Diehr
and Lutton patent application may later be challenged for failure to
satisfy the requirements of §§ 102 and 103. See *ante,* at 191. This sug-
gestion disregards the fact that the applicants overcame all objections to
issuance of the patent except the objection predicated on § 101. The
Court seems to assume that §§ 102 and 103 issues of novelty and ob-
viousness remain open on remand. As I understand the record, however,
those issues have already been resolved. See Brief for Respondents 11-14;
Reply Memorandum for Petitioner 3-4, and n. 4. Therefore, the Court is
now deciding that the patent will issue.

[34] The early cases that the Court of Customs and Patent Appeals re-
fused to follow in *Prater, Musgrave,* and *Benson* had recognized the dis-
tinction between the § 101 requirement that what the applicant claims to
have invented must be patentable subject matter and the § 102 require-
ment that the invention must actually be novel. See, *e. g., In re Shao Wen
Yuan,* 38 C. C. P. A. (Pat.), at 973-976, 188 F. 2d, at 382-383; *In re
Abrams,* 38 C. C. P. A. (Pat.), at 951-952, 188 F. 2d, at 169; *In re
Heritage,* 32 C. C. P. A. (Pat.), at 1173-1174, 1176-1177, 150 F. 2d, at
556, 558; *Halliburton Oil Well Cementing Co.* v. *Walker.* 146 F. 2d, at
821, 823. The lower court's error in this case, and its unenthusiastic re-
ception of *Gottschalk v. Benson* and *Parker v. Flook,* is, of course, con-

claim that anything constituting patentable subject matter
has been discovered, there is no occasion to address the
novelty issue.[35]   Or, as was true in *Flook*, if the only concept
that the inventor claims to have discovered is not patentable
subject matter, § 101 requires that the application be rejected
without reaching any issue under § 102; for it is irrelevant
that unpatentable subject matter—in that case a formula for
updating alarm limits—may in fact be novel.

Proper analysis, therefore, must start with an understand-
ing of what the inventor claims to have discovered—or
phrased somewhat differently—what he considers his inven-
tive concept to be.[36]   It seems clear to me that Diehr and

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sistent with its expansive reading of § 101 in *Tarczy-Hornoch*, *Prater*, and
their progeny.

[35] The Court's opinion in *Flook* itself pointed out this distinction:

"The obligation to determine what type of discovery is sought to be
patented must precede the determination of whether that discovery is, in
fact, new or obvious."   437 U. S., at 593.

As the Court of Customs and Patent Appeals noted in this case, "for the
claim to be statutory, there must be some substance to it other than the
recitation and solution of the equation or formula."   602 F 2d, at 988.
See Comment, 62 J. Pat. Off. Soc., *supra* n. 22, at 522–523.

[36] The Court fails to focus upon what Diehr and Lutton claim to have
discovered apparently because it believes that this method of analysis
would improperly import novelty considerations into § 101.   See *ante*,
at 188–191, 193, n. 15.   Rather than directing its attention to the applicants'
claimed discovery, the Court instead focuses upon the general industrial
context in which the applicants intend their discovery to be used.   Implicit
in this interpretation of the patent application is the assumption that, as
long as the claims describe a specific implication of the applicants' dis-
covery, patentable subject matter is defined.   This assumption was ex-
pressly rejected in *Flook*:

"This assumption is based on respondent's narrow reading of *Benson*,
and is as untenable in the context of § 101 as it is in the context of that
case.   It would make the determination of patentable subject matter
depend simply on the draftsman's art and would ill serve the principles
underlying the prohibition against patents for 'ideas' or phenomena of
nature.   The rule that the discovery of a law of nature cannot be pat-

Lutton claim to have developed a new method of programming a digital computer in order to calculate—promptly and repeatedly—the correct curing time in a familiar process.[37] In the § 101 analysis, we must assume that the sequence of steps in this programming method is novel, unobvious, and useful. The threshold question of whether such a method is patentable subject matter remains.

If that method is regarded as an "algorithm" as that term was used in *Gottschalk* v. *Benson*, 409 U. S. 63 (1972), and in

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ented rests, not on the notion that natural phenomena are not processes, but rather on the more fundamental understanding that they are not the kind of 'discoveries' that the statute was enacted to protect." 437 U. S., at 593 (footnote omitted).

[37] A few excerpts from the original patent application will emphasize this point.

"The invention will probably best be understood by first describing a simple example, in which a single mold is involved and in which the information is relatively static.

. . . . .

"A standard digital computer may be employed in this method. It has a data storage bank of suitable size which, of course, may vary when many molds are used and when more refinements are employed. However, Fig. 1 shows a relatively simple case which achieves results that are vast improvements over what has been done up to now. . . .

"The data bank of the computer is provided with a digital input into which the time-temperature cure data for the compound involved is fed, as shown in Fig. 1. All the data is available to the computer upon call, by random access, and the call can be automatic depending upon the temperature actually involved. In other words, the computer over and over questions the data storage, asking, what is the proper time of cure for the following summation of temperatures? The question may be asked each second, and the answer is readily provided.

. . . . .

"Recalculation continues until the time that has elapsed since mold closure corresponds with the calculated time. Then, the computer actuates the mold-opening device and the mold is automatically opened." App. to Pet. for Cert. 43a–45a.

Parker v. *Flook*, 437 U. S. 584 (1978),[14] and if no other inventive concept is disclosed in the patent application, the question must be answered in the negative. In both *Benson* and *Flook*, the parties apparently agreed that the inventor's discovery was properly regarded as an algorithm; the holding that an algorithm was a "law of nature" that could not be

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The Figure 1 referred to in the application is as follows:

Arrhenius Reaction Constants for Compound	Actual Mold Temperature Every 10 Seconds	Compares Calculated Cure Time with Elapsed Cure Time Every Second

Data Storage → Computer → Actuates Mold Opening When Calculated Cure Time Equals Elapsed Cure Time

Input Signal to Start ↑

Interim Timing in Computer

Close Mold Manually

Controls Mold Platen Temperature with Proportional Control Algorithm

Id., at 53a.

[14] In *Benson*, we explained the term "algorithm" in the following paragraph:

"The patent sought is on a method of programming a general-purpose digital computer to convert signals from binary-coded decimal form into pure binary form. A procedure for solving a given type of mathematical problem is known as an 'algorithm.' The procedures set forth in the present claims are of that kind; that is to say, they are a generalized formulation for programs to solve mathematical problems of converting one form of numerical representation to another. From the generic formulation, programs may be developed as specific applications." 409 U. S., at 65.

patented therefore determined that those discoveries were not patentable processes within the meaning of § 101.

As the Court recognizes today, *Flook* also rejected the argument that patent protection was available if the inventor did not claim a monopoly on every conceivable use of the algorithm but instead limited his claims by describing a specific postsolution activity—in that case setting off an alarm in a catalytic conversion process. In its effort to distinguish *Flook* from the instant case, the Court characterizes that postsolution activity as "insignificant," *ante,* at 191, or as merely "token" activity, *ante,* at 192, n. 14. As a practical matter, however, the postsolution activity described in the *Flook* application was no less significant than the automatic opening of the curing mold involved in this case. For setting off an alarm limit at the appropriate time is surely as important to the safe ar d efficient operation of a catalytic conversion process as is actuating the mold-opening device in a synthetic rubber-curing process. In both cases, the post-solution activity is a significant part of the industrial process. But in neither case should that activity have any *legal* significance because it does not constitute a part of the inventive concept that the applicants claimed to have discovered."

In *Gottschalk* v. *Benson,* we held that a program for the

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[*] In *Flook*, the Court's analysis of the postsolution activity recited in the patent application turned, not on the relative significance of that activity in the catalytic conversion process, but rather on the fact that that activity was not a part of the applicant's discovery:

"The notion that post-solution activity, no matter how conventional or obvious in itself, can transform an unpatentable principle into a patentable process exalts form over substance. A competent draftsman could attach some form of post-solution activity to almost any mathematical formula; the Pythagorean theorem would not have been patentable, or partially patentable, because a patent application contained a final step indicating that the formula, when solved, could be usefully applied to existing surveying techniques. The concept of patentable subject matter under § 101 is not 'like a nose of wax which may be turned and twisted in any direction . . . .' *White* v. *Dunbar,* 119 U. S. 47, 51." 437 U. S., at 590 (footnote omitted).

solution by a digital computer of a mathematical problem was not a patentable process within the meaning of § 101. In *Parker* v. *Flook*, we further held that such a computer program could not be transformed into a patentable process by the addition of postsolution activity that was not claimed to be novel. That holding plainly requires the rejection of Claims 1 and 2 of the Diehr and Lutton application quoted in the Court's opinion. *Ante*, at 179–180, n. 5. In my opinion, it equally requires rejection of Claim 11 because the presolution activity described in that claim is admittedly a familiar part of the prior art.[40]

Even the Court does not suggest that the computer program developed by Diehr and Lutton is a patentable discovery. Accordingly, if we treat the program as though it were a familiar part of the prior art—as well-established precedent requires[41]—it is absolutely clear that their application contains no claim of patentable invention. Their application was therefore properly rejected under § 101 by the Patent Office and the Board of Appeals.

IV

The broad question whether computer programs should be given patent protection involves policy considerations that

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[40] Although the Court of Customs and Patent Appeals erred because it ignored the distinction between the § 101 requirement that the applicant must claim to have discovered a novel process and the § 102 requirement that the discovery must actually be novel, that court correctly rejected the argument that any difference between Claim 11 and the earlier claims was relevant to the § 101 inquiry. See 602 F. 2d, at 984, 987–988.

[41] This well-established precedent was reviewed in *Parker* v. *Flook*:

"*Mackay Radio* and *Funk Bros.* point to the proper analysis for this case: The process itself, not merely the mathematical algorithm, must be new and useful. Indeed, the novelty of the mathematical algorithm is not a determining factor at all. Whether the algorithm was in fact known or unknown at the time of the claimed invention, as one of the 'basic tools of scientific and technological work,' see *Gottschalk* v *Benson.* 409 U. S., at 67, it is treated as though it were a familiar part of the prior art " 437 U S., at 591–592.

this Court is not authorized to address. See *Gottschalk* v.
Benson, 409 U. S., at 72–73; *Parker* v. *Flook*, 437 U. S., at
595–596. As the numerous briefs *amicus curiae* filed in
Gottschalk v. *Benson, supra, Dann* v. *Johnston*, 425 U. S. 219
(1976), *Parker* v. *Flook, supra,* and this case demonstrate, that
question is not only difficult and important, but apparently
also one that may be affected by institutional bias. In each of
those cases, the spokesmen for the organized patent bar have
uniformly favored patentability and industry representatives
have taken positions properly motivated by their economic
self-interest. Notwithstanding fervent argument that patent
protection is essential for the growth of the software indus-
try,[42] commentators have noted that "this industry is grow-
ing by leaps and bounds without it."[43] In addition, even

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[42] For example, the Association of Data Processing Service Organiza-
tions, appearing as *amicus curiae* in *Flook,* made the following policy
argument:

"The need of the incentive of patents for software is at least as great
as that of the incentive available for hardware, because: 'Today, provid-
ing computer software involves greater . . . risk than providing com-
puter . . . hardware. . . .'

"To a financial giant, the economic value of a patent may not loom
large; to the small software products companies upon which the future
of the development of quality software depends, the value of the patent
in financing a small company may spell the difference between life and
death. To banks and financial institutions the existence of a patent or
even the potentiality of obtaining one may well be a decisive factor in
determining whether a loan should be granted. To prospective investors
a patent or the possibility of obtaining one may be the principal element
in the decision whether to invest.

"Making clear that patents may be available for inventions in software
would unleash important innovative talent. It would have the direct
opposite effect forecast by the . . . hardware manufacturers; it would
enable competition with those companies and provide the needed incen-
tive to stimulate innovation." Brief for ADAPSO as *Amicus Curiae* in
Parker v. *Flook,* O. T. 1977, No. 77–642, p. 44 (footnote omitted).

[43] Gemignani, *supra* n. 1, at 309. In a footnote to that comment, Pro-
fessor Gemignani added that the rate of growth of the software industry

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some commentators who believe that legal protection for computer programs is desirable have expressed doubts that the present patent system can provide the needed protection.[44]

Within the Federal Government, patterns of decision have also emerged. Gottschalk, Dann, Parker, and Diamond were not ordinary litigants—each was serving as Commissioner of Patents and Trademarks when he opposed the availability of patent protection for a program-related invention. No doubt each may have been motivated by a concern about the ability of the Patent Office to process effectively the flood of applications that would inevitably flow from a decision that computer programs are patentable.[45] The consistent concern evidenced by the Commissioner of Patents and Trademarks and by the Board of Appeals of the Patent and Trademark Office has not been shared by the Court of Customs and Patent Appeals, which reversed the Board in *Benson, Johnston,* and *Flook,* and was in turn reversed by this Court in each of those cases.[46]

"has been even faster lately than that of the hardware industry which does enjoy patent protections." *Id.,* at 309, n. 259. Other commentators are in accord. See Nycum, Legal Protection for Computer Programs, 1 Computer L. J. 1, 55-58 (1978); Note, Protection of Computer Programs: Resurrection of the Standard, 50 Notre Dame Law. 333, 344 (1974).

[44] See, *e. g.,* Gemignani, *supra* n. 1, at 301–312; Keefe & Mahn, Protecting Software: Is It Worth All the Trouble?, 62 A. B. A. J. 906, 907 (1976).

[45] This concern influenced the President's Commission on the Patent System when it recommended against patent protection for computer programs. In its report, the President's Commission stated:

"The Patent Office now cannot examine applications for programs because of the lack of a classification technique and the requisite search files. Even if these were available, reliable searches would not be feasible or economic because of the tremendous volume of prior art being generated. Without this search, the patenting of programs would be tantamount to mere registration and the presumption of validity would be all but nonexistent." Report of the President's Commission, *supra* n. 10, at 13.

[46] It is noteworthy that the position of the Court of Customs and Patent Appeals in the process patent area had been consistent with that

Scholars have been critical of the work of both tribunals. Some of that criticism may stem from a conviction about the merits of the broad underlying policy question; such criticism may be put to one side. Other criticism, however, identifies two concerns to which federal judges have a duty to respond. First, the cases considering the patentability of program-related inventions do not establish rules that enable a conscientious patent lawyer to determine with a fair degree of accuracy which, if any, program-related inventions will be patentable. Second, the inclusion of the ambiguous concept of an "algorithm" within the "law of nature" category of unpatentable subject matter has given rise to the concern that almost any process might be so described and therefore held unpatentable.

In my judgment, today's decision will aggravate the first concern and will not adequately allay the second. I believe both concerns would be better addressed by (1) an unequivocal holding that no program-related invention is a patentable process under § 101 unless it makes a contribution to the art that is not dependent entirely on the utilization of a computer, and (2) an unequivocal explanation that the term "algorithm" as used in this case, as in *Benson* and *Flook*, is synonymous with the term "computer program."[47] Because

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of the Commissioner of Patents and Trademarks for decades prior to 1968. As discussed in Part I, *supra*, in that year the court rejected two longstanding doctrines that would have foreclosed patentability for most computer programs under § 101.

[47] A number of authorities have drawn the conclusion that the terms are in fact synonymous. See, *e. g.*, Novick & Wallenstein, *supra* n. 5, at 333, n. 172; Anderson, Algorithm, 1 Encyclopedia of Computer Science & Technology 364, 369 (J. Belzer, A. Holzman & A. Kent eds. 1975); E. Horowitz & S. Sahni, Fundamentals of Computer Algorithms 2 (1978); A. Tanenbaum, Structured Computer Organization 10 (1976). Cf. Blumenthal & Riter, *supra* n. 15, at 455–456; Gemignani, *supra* n. 1, at 271–273, 276, n. 37.

the invention claimed in the patent application at issue in this case makes no contribution to the art that is not entirely dependent upon the utilization of a computer in a familiar process, I would reverse the decision of the Court of Customs and Patent Appeals.

Appendix E

Dickerman Associates, Inc. v. Tiverton Bottled Gas Company
564 F. Supp. 30 (D. Mass. 1984).

ZOBEL, District Judge.

Plaintiff brought this action to redress the alleged misappropriation by defendants of its trade secrets and proprietary rights in computer software. By agreement of the parties, trial of the case was bifurcated and the only issue tried initially was the liability of all defendants except Tiverton Bottled Gas Company. At the close of plaintiff's evidence, the motion of defendant, Rehab Computer, Incorporated, was allowed for failure of plaintiff to prove that defendant's complicity in any wrongdoing. The defendants remaining are Brian J. Vaill ("Vaill") and Dealers Management Services, Inc. ("DMS"), a company formed by Vaill and of which he serves as an officer and director.

The parties agreed before trial that defendants' liability depended upon proof by plaintiff of three elements:[1] (1) that its computer program is a trade secret; (2) that it made reasonable efforts to keep the program secret; and (3) that Vaill and an associate, Jay DeYoung, copied plaintiff's program and included substantial portions thereof in the product being sold by DMS. They stipulated that plaintiff's program has a value and that DMS sells a program in competition with plaintiff. The following shall constitute my findings of fact and conclusions of law.

In 1976, Standard Oil Company of Indiana, in an effort to diversify, decided to develop a computer program to provide accounting and management information and support to independent petroleum distributors or jobbers, many of whom had, under an earlier distribution system, been employees of the company. A subsidiary, Amoco Computer Services Company, was assigned the development task under the direction of Terry R. Beal, an Amoco Product Manager and experienced computer

complaint was filed shortly after it was clear that settlement was not possible. I do not deem the delay improper.

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specialist. He started by purchasing a software package from one John Grady, a programmer. Grady's program was designed for retail fuel oil dealers and was inadequate for the needs of the jobbers or bulk dealers. Beal set about to rebuild and improve the original package and named the new program "Jobber Management System" ("JMS"). He obtained the assistance of Grady, Howard Dickerman, plaintiff's principal and at that time a 21-year-old college drop-out and computer whizz, and two others. They developed the program in direct response to the articulated needs of prospective users. Indeed, a substantial portion of the time spent by the team was expended in determining the requirements of and designing the specifications for the system. I credit Beal's testimony that the development effort consumed at least twenty-two man months until the first sale and an additional twelve months to the first installation. It cost approximately $400,000, including the price paid Grady.

Although JMS is a good and useful tool, it was not at all successful from Amoco's point of view. Sales of the system lagged far behind projections and in 1981 Amoco sold it to plaintiff for the sum of $125,000. Plaintiff, which was founded by Howard Dickerman, is engaged in the business of licensing, selling and servicing JMS.

The JMS program starts with a "Systems Options Menu," the main menu, which includes five major and five minor groupings of functional options. The five major groupings are called "File Maintenance," "Dispatching," "Posting," "Billing" and "Reports." The five minor groupings are for various housekeeping functions: "Start of Day," "End of Day," and routines for protecting information fed into the system. The major groupings determine the organization of the system and were chosen by the designers, Beal, Grady and Dickerman, from an infinite number of alternatives. (Grady's original system had 10-12 menus.) They are assigned the actual operating programs. "File Maintenance" is a constantly changing store of information of customer names, addresses, requirements, account

numbers, and account status, as well as other useful details concerning customers. The "Dispatching" submenu is used to schedule deliveries in advance and to respond to customer requests for immediate delivery. For both contingencies, it prints delivery tickets which are used by the driver as his instructions. "Posting" is designed to keep the information in the computer current and to enter the various business transactions as they occur. The fourth grouping, "Billing," is the smallest. It is used primarily in connection with the preparation of monthly bills and is able to add finance charges or rental fees; it computes sales taxes, and it permits easy management of budget accounts. The "Reports" submenu is the essential management tool. It is designed to produce periodically or "on request" various information, such as reports, showing accounts receivable by age, tax reports, and sales analyses. It can produce these by division of a company, by product, alphabetically, by type of account, or numerically.

The manner in which JMS receives information, processes it, and then produces new data is unique. For example, the "Daily Operating Control Report" has ten or twelve different sections: sales, accounts receivable, activities of trucks, etc. All are produced by the operator simply requesting the computer to "Process All Data," which causes the computer to scan all relevant files. The "File Maintenance" submenu has separate programs for adding, changing or deleting customer records and includes separate files for delivery and billing addresses. The "Posting" submenu separates the entering and processing of transactions, a decision made because the early computers worked relatively slowly. It also divided the transactions to be posted into five categories—"Liquid" and/or "Package Deliveries," "Miscellaneous Debits" and/or "Credits," and "Enter Payments"—although a different number and arrangement was equally feasible. The program displays running totals during the posting process, a feature not necessarily required. The "System Reports" submenu

not only permits the generation of a wide range of reports, from customer listings to sales analyses and budget projections, but is programmed to produce mailing labels and Rolodex cards.

When a dealer acquires a new customer, information about him is added into the computer by means of a specifically designed series of questions. A query about the customer's "zone" is designed to assist the driver in finding the customer's home, as is routing information requested. The program includes questions about the customer's needs—the primary product to be furnished, the type of equipment, and the number of trucks the customer has, and at what intervals deliveries are to be made. It has room for additional information, such as the location of the filler pipe or warnings about dogs. The system moreover includes a field whereby a customer may be assigned to a particular division.

The customer display screen demonstrates numerous design decisions. While the inclusion of certain information, name, address, billing and payment data is self evident, it is less imperative that this screen should, for example, show year to date delivery and payment data, or that it be arranged in the precise manner of the JMS.

In addition to choosing the particular five major groupings for the purposes outlined, the designers thus made decisions concerning the specific manner in which these submenus are to be used, how they are to be accessed, how many screens to use, and how to arrange the information on each screen. It is the organization of the JMS program with its five major groupings, combined with the particular features within the system and the procedures to be employed in its use, which plaintiff claims as its trade secret. The system is complex and is unique.

Defendant Vaill had no formal training in designing computer programs or as a programmer, but he had gained considerable experience in systems design while employed at the Providence Gas Company from 1966 to 1981. During his tenure at

the Providence Gas Company, a public utility which supplied natural gas, Vaill had been involved in working on routing systems for meter readers, a customer accounting system, and an appliance inventory system. He had also assisted various computer companies in translating his employer's needs into programs. He had started there as a clerical employee, advanced to the position of management trainee, and by the late 70s had worked himself up to general manager of Tiverton Bottled Gas Co., ("Tiverton") a then newly acquired subsidiary.

Tiverton, an LP-gas dealer, had at the time of the acquisition a manual accounting system. Vaill investigated and considered a number of computerized systems and eventually settled on JMS. In February 1980, Tiverton contracted to purchase JMS, and in April of that year it was installed. Although Vaill did not sign the contract for Tiverton, it is undisputed that the sale was made subject to an agreement by Tiverton to "treat as confidential all programs, documents and other information relating to JMS...." Indeed, all sales of JMS were made under similar agreements. I find that Vaill was aware of the confidentiality clause and of plaintiff's concern to keep the design of JMS secret.

Vaill found JMS an easy system to learn and soon became intimately familiar with it. At some time in 1980, pursuant to an agreement with Howard Dickerman, he even assisted in demonstrating JMS to other potential buyers and received a commission from plaintiff for sales he had facilitated. During demonstrations of the system by Vaill or Dickerman, a prospective customer necessarily learns some aspects of the program. Plaintiff did not restrict Vaill in the manner in which he carried out such of the demonstrations as he conducted, nor did it extract confidentiality agreements from prospective customers. Nevertheless, the portions of JMS disclosed during a demonstration represent a small fraction of the whole, and I credit Dickerman's testimony that they are too limited to permit an understanding of the program's de-

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sign and architecture. Prospective customers at such demonstrations do not see the entire menu and all of the submenus, nor do they see any user's guide or manual. Whenever anyone evinces a serious interest, plaintiff requires a written undertaking to keep confidential anything disclosed before permitting a more detailed review of the program and a look at the user's guide.

In the course of his work at Providence Gas Company and later at Tiverton, Vaill had become acquainted with Jay DeYoung, who was then a computer programmer employed by Rehab Computer Incorporated, a data processing concern based in Washington, D.C. They had cooperated on one project for Providence Gas, and in the fall of 1979, Vaill requested DeYoung to estimate the cost of designing a program for LP-gas dealers and particularly Tiverton. Although they did not then go forward with the latter project, they recommenced discussions about developing a software package for general distribution in October 1980. Vaill went to Washington, D.C. for a meeting with DeYoung and Messrs. McCoy and Quigg, two officers of Rehab whom Vaill sought to enlist in the enterprise. The presentation to McCoy and Quigg said very little about the design and documentation of the proposed package, but focused almost entirely on marketing. No commitments were made, but after additional discussions between Vaill and DeYoung, the latter came to Providence in February 1981 to work on a system.

DeYoung worked at Tiverton for two weeks in February, one week in March, and one week in April, and utilized the Wang computer which belonged to Tiverton. He denied having used the JMS manual. I do not credit that testimony. By the end of February, Vaill and DeYoung had documented sixteen files,[2] including a "Customer Master File" in nearly final form. By that time they had also developed all forty-nine fields which constitute the final ver-

sion of their program. DeYoung managed all of that even though he worked on the computer for no more than three to four weeks and admittedly did not utilize the Wang utility system, called "IDEAS," at least for the "Customer Master File."

Although defendants claimed to have incurred substantial "development costs," the evidence is devoid of specific figures. The testimony suggests, moreover, that "development costs" included not so much amounts expended on developing a program but rather amounts spent on developing a market for FuelPak. In late March, Vaill and DeYoung caused the training materials to be erased from one of the JMS disks and used it for their system which they then exhibited at a trade show in early April. They "borrowed" a second disk, a blank one from Tiverton, to make another copy of their program for use at that and other trade shows. These disks were returned to Tiverton sometime in June only after Tiverton demanded their return. Vaill and DeYoung ceased having access to JMS materials, except for the two disks, in early May when Tiverton fired Vaill for his activities in connection with the development of FuelPak.

DeYoung testified that from October 1980 on he made notes about the design of a program, most of which he later destroyed. He did, however, keep some papers, including an outline, dated February 17, 1981, of a customer master file. That document, together with another outline, dated February 19, 1981, which shows numerous items to be included, is remarkably similar to the JMS customer file. Other notes of Vaill, DeYoung and their assistant, Gary Hannon, show a tracking of the JMS "Transaction Posting" screen and the "Add-A-Customer" program. Some of the titles of particular files were changed but the resemblances disclosed by the notes, and others mentioned below, permit the

2. A "file" is the physical area on a magnetic disc where information is stored. A "record" is data in a file which relates to a particular subject, and a "field" is a specific area within a record for storing particular information concerning

the subject. If the file is analogous to a telephone book, the record is all the information pertaining to one name and the field, each piece of such information, such as the telephone number or the address.

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inference, which I draw, that Vaill and DeYoung copied substantial portions of their system from JMS.

Certain of the features of both programs are clearly dictated by the needs of the businesses for which the programs are designed. Fuel oil dealers must have information about their customers' addresses, the status of their accounts, and their requirements for fuel oil, and other products. They must have the ability to predict customer requirements and to route deliveries efficiently. However, these broad needs do not predetermine the precise manner in which a computer system has to satisfy them, and the striking aspect of this case is the similarity of approach to these not uncommon problems. For example, both systems include five major groupings which performed substantially similar functions. The "Transaction Posting" submenu of both uses the same five batch heads. The fields are listed across the screen in the same order, although JMS has one field which is not included in FuelPak and the total is displayed differently. In both, the entry of data is separate from processing data, although they could have been combined. In neither can batches be closed explicitly, rather they are closed by starting a new batch. The "Add-A-Customer" program of both systems includes a field whereby the customer is assigned to a division of the company. Both have three fields concerning deliveries, "automatic," "will call," and "Julian," and where JMS uses for its delivery code numerical designations 1, 2 and 3, FuelPak uses a similar sequential code, 11, 22 and 33. Although the manner of daily closing is somewhat different on the two systems, both produce the same six reports. I credit the testimony of plaintiff's expert, Professor Robert Kinicki, that these and other similarities are not accidental and that certain cosmetic differences were incorporated in FuelPak to disguise copying. I further credit his testimony and find that the time needed to produce a system like FuelPak far exceeds the time, in fact, expended on development by Vaill, DeYoung and their assistants, even taking into account Vaill's familiarity with the fuel oil business.

2. Trade secret protection may be afforded to any idea, process, or compilation of information valuable and useful in one's business and which is not generally known. A trade secret is any special knowledge developed through skill and ingenuity and the expenditure of money and effort which, by being secret, gives the owner an advantage over his competitors. *Atlantic Wool Combing Co. v. Norfolk Mills, Inc.*, 357 F.2d 866 (1st Cir.1966); *Rapco Foam, Inc. v. Scientific Applications*, 479 F.Supp. 1027 (S.D.N.Y.1979). In determining whether a particular idea is entitled to protection, the Court should consider the degree of secrecy surrounding it, the efforts expended in developing it and preserving its secrecy, its value to plaintiff and defendant, and the difficulty of duplicating it. *Rapco Foam, Inc. v. Scientific Applications*, 479 F.Supp. at 1029. Thus, plaintiff need not prove that its system is novel in the patent law sense; *Cataphote Corporation v. Hudson*, 444 F.2d 1313 (5th Cir.1971). Plaintiff need only show that the particular architecture of its program is valuable, that it is not a matter of common knowledge or readily duplicated, and that it was developed and has been kept secret through plaintiff's efforts.

• Plaintiff has met that burden. JMS reflects a series of design decisions which resulted in a complex but coherent program for a specific market. The program is neither random nor self evident and was developed at substantial expense. While, as noted earlier, some of the screens are mandated by the needs of the market, the particular combination of procedures used in plaintiff's system, and the particular features within the system detailed earlier, are neither obvious nor easily duplicated. They constitute a trade secret. Those features differentiated plaintiff's system from other computer programs and they gave plaintiff such competitive advantage as it had.

Such difficulties as exist in applying the general definitions and principles of the

law of trade secrets to computer software are particularly apparent when considering the adequacy of plaintiff's efforts to ensure the secrecy of its program. Both parties demonstrated the relative ease with which one knowledgeable in the science or, as the case may be, art of computers can discern not only the general outline of a program but also its source code. Nevertheless, I conclude that plaintiff took adequate precautions to protect the secrecy of its product.

Based upon the similarities of the two programs detailed earlier, DeYoung's notes, the availability of the JMS manual to Vaill and DeYoung, their use of it, and the speed with which they assembled their system, the conclusion that they copied substantial portions of JMS is inescapable. Vaill does not seriously contest that he was bound by the confidentiality agreement of Tiverton. I find that he did violate that confidential relationship.

Accordingly, plaintiff's motion for the entry of a finding that defendants Vaill and Dealer Management Services, Inc. are liable to plaintiff for misappropriation of its trade secrets is allowed. Plaintiff shall submit a proposed form of injunction.

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Appendix F

The Legal Protection Available for Air Force Software

Paragraph numbers refer to the DOD FAR supplement.

SOFTWARE PRODUCT   GOVERNMENT RIGHTS


```
                                          GOVERNMENT GETS
OFF                      yes              RESTRICTED RIGHTS
THE                                       27.404-1(b), (c),
SHELF? --------------------------------->  27.406(a)
   |
   | no
   V

                                          GOVERNMENT GETS
SPECIAL                  yes              EXCLUSIVE RIGHTS
WORKS? ------------------------------->   27.402(c), (d)
   |
   | no
   V

GOVERNMENT CONTRACT      yes              GOVERNMENT GETS
FIRST PREPARED?      ---------------->    UNLIMITED RIGHTS
   |                                      27.404-1(a),
   |                                      27.402(c), (d)
   |                                              ^
   | no                                           | yes
   V

GOVERNMENT CONTRACT      yes              CONTRACTOR HAS
NOT FIRST PREPARED   ---------------->    COPYRIGHTS?
   |                                          |
   | no                                       | no
   |                                          V

                                          CONTRACTOR MUST HAVE
                                          GOVERNMENT'S PER-
                                          MISSION TO INCLUDE THE
                                          COPYRIGHTED SOFTWARE;
                                          GOVERNMENT GETS
                                          RESTRICTED RIGHTS
   V                                      27.404-1(d), 27.402(e)
```
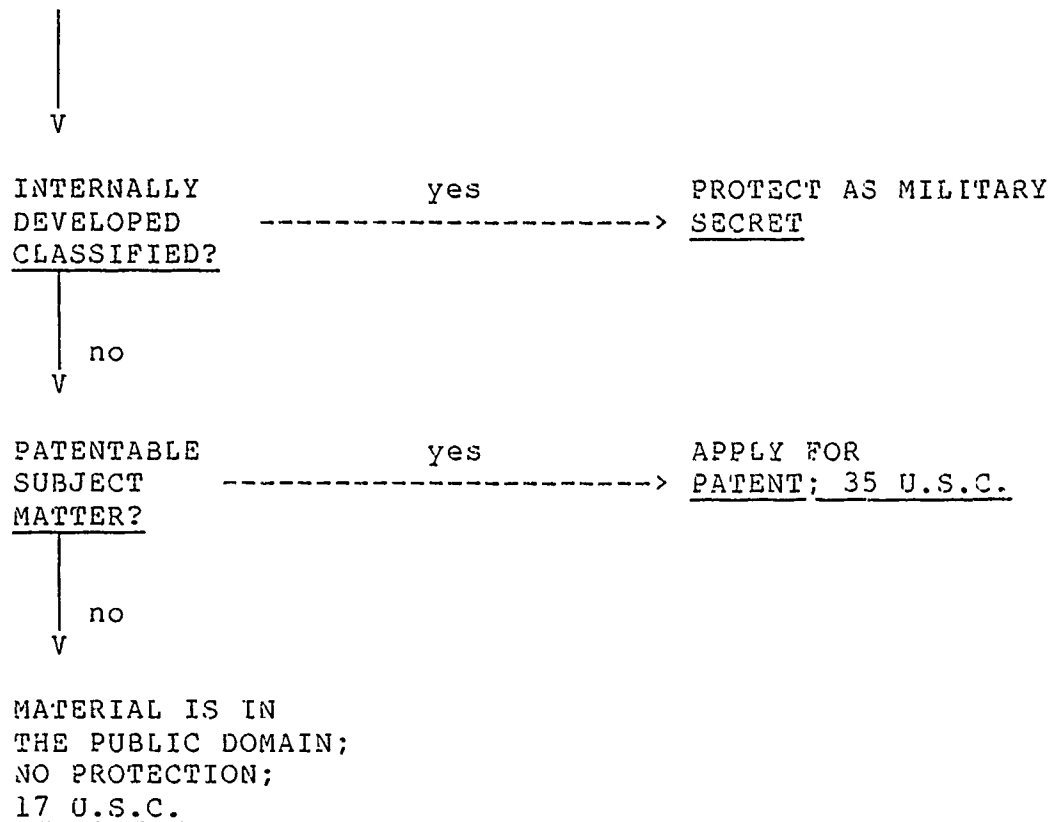
```
                |
                V

        INTERNALLY              yes             PROTECT AS MILITARY
        DEVELOPED      -------------------->     SECRET
        CLASSIFIED?

                |
                | no
                V

        PATENTABLE              yes             APPLY FOR
        SUBJECT        -------------------->     PATENT; 35 U.S.C.
        MATTER?

                |
                | no
                V

        MATERIAL IS IN
        THE PUBLIC DOMAIN;
        NO PROTECTION;
        17 U.S.C.
```

DEFINITIONS: (DOD FAR Supplement 17.401)

UNLIMITED RIGHTS: rights to use, duplicate, or disclose in whole or in
part, in any manner and for any purpose whatsoever, and to have or
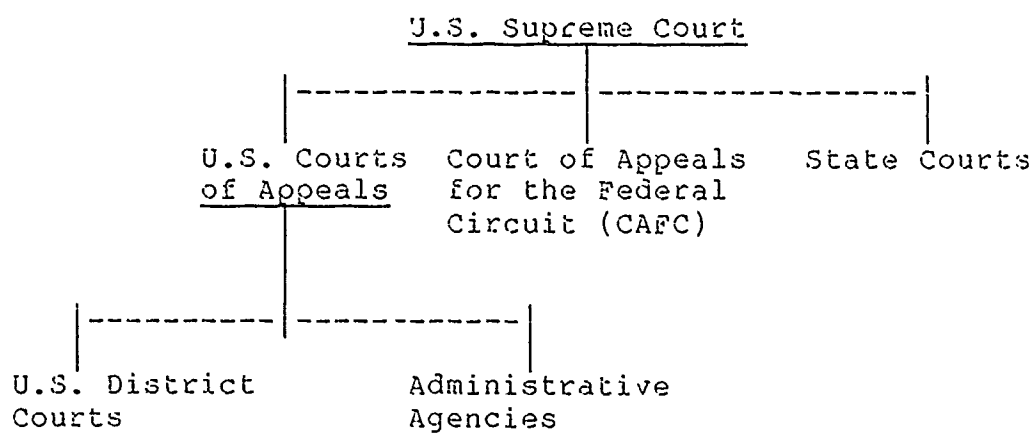permit others to do so.

RESTRICTED RIGHTS: include as a minimum, the right to:
  (a) use software with the computer for which or with which it was
      acquired, including use at any government installation to which
      the computer may be transferred by the government;
  (b) use software with a backup computer if the computer for which or
      with which it was acquired is inoperative;
  (c) copy computer programs for safekeeping (archives) or backup
      purposes; and
  (d) modify software, or combine it with other software, subject to
      the provision that those portions of the derivative software
      incorporating restricted rights software are subject to the same
      restricted rights.
In addition, any other specific rights not inconsistent with the
minimum rights listed in (a)-(d) above that are listed or described
in a contract or a license agreement that is part of a contract.

Appendix G

The U.S. Court System (21:53)

```
                    U.S. Supreme Court
          |--------------------|--------------------|
     U.S. Courts      Court of Appeals      State Courts
     of Appeals       for the Federal
                      Circuit (CAFC)
          |-----------|-----------|
     U.S. District         Administrative
     Courts                Agencies
```

Appendix N

The U.S. Dual Court System and Routes of Appeal (21:50)

Courts Are Listed From Lowest To Highest

Federal Courts

1. District courts

2. Circuit Courts of Appeal

3. Supreme Court of the U.S.

State Courts

1. Trial courts of limited jurisdiction

2. Trial courts of general jurisdiction

3. Intermediate courts of appeals

4. Appellate court of last resort

5. Supreme Court of the U.S.

Appendix I

Copyright Cases

Goldstein v. California, 93 S. Ct. 2303, (1973).

Synercom Technology, Inc. v. University Computing Co., 462 F. Supp. 1003 (N.D. Texas 1978).

Data Cash Systems, Inc. v. JS&A Group, Inc., 480 F. Supp. 1063 (N.D. Ill. 1979).

Data Cash Systems, Inc. v. JS&A Group, Inc., 628 F.2d 1038 (7th Cir. 1980).

Stern Electronics, Inc. v. Kaufman, 523 F. Supp. 635 (E.D.N.Y. 1981).

Tandy Corp. v. Personal Micro Computers, Inc., 524 F. Supp. 171 (N.D. Cal. 1981).

Stern Electronics, Inc. v. Kaufman, 669 F.2d 852 (2d Cir. 1982).

Williams Electronics, Inc. v. Artic International, Inc.,
685 F.2d 870 (3d Cir. 1982).

Apple Computer, Inc. v. Franklin Computer Corp., 545 F.
Supp. 812 (E.D. Penn. 1982).

Midway Manufacturing Co. v. Strohon, 564 F. Supp. 741 (N.D.
Ill. 1983).

Apple Computer, Inc. v. Franklin Computer Corp., 714 F.2d
1240 (3d Cir. 1983).

Apple Computer, Inc. v. Formula International, Inc., 725
F.2d 521 (9th Cir. 1984).

Patent Cases

Gottschalk v. Benson, 93 S. Ct. 253 (1972).

Dann v. Johnston, 96 S. Ct. 1393 (1976).

Parker v. Flook, 98 S. Ct. 2522 (1978).

In re Bradley, 600 F.2d 807 (C.C.P.A. 1979).

Diamond v. Diehr, 101 S. Ct. 1048 (1981).

In re Abele, 684 F.2d 902 (C.C.P.A. 1982).

In re Pardo, 684 F.2d 912 (C.C.P.A. 1982).

Trade Secret Cases

Servo Corp. v. General Electric Co., 393 F.2d 551 (4th Cir. 1968).

Com-Share, Inc. v. Computer Complex, Inc., 338 F. Supp. 1229 (E.D. Mass. 1971).

University Computing Co. v. Lykes-Youngstown Corp., 504 F.2d 518 (5th Cir. 1974).

U.S. v. Seidlitz, 589 F.2d 152 (4th Cir. 1978).

Warrington Associates, Inc. v. Real-Time Engnieering Systems, Inc., 522 F. Supp. 367 N.D> Ill. 1981).

Moore v. Honeywell Information Systems, 558 F. Supp. 1229 (D. Hawaii 1983).

Videotronics, Inc. v. Bend Electronics, 564 F. Supp. 1471
(D. Nev. 1983).

Dickerman Associates v. Tiverton Bottled Gas Company, 564
F. Supp. 30 (D. Mass. 1984).

Business Intelligence Services, Inc. v. Hudson, 580 F.
Supp. 1068 (S.D.N.Y. 1984).

Appendix J

The Software Engineering Life Cycle (22:13)

STEP	DOCUMENT PRODUCED
1. SYSTEM ANALYSIS	SYSTEMS REQUIREMENTS DOCUMENT
2. REQUIREMENTS DEFINITION	SOFTWARE REQUIREMENTS DOCUMENT
3. PRELIMINARY DESIGN	PRELIMINARY (LOGICAL) DESIGN DOCUMENT
4. DETAILED DESIGN	DETAILED (PHYSICAL) DESIGN DOCUMENT
5. CODE	SOURCE CODE LISTING
6. TEST	TEST RESULTS DOCUMENT.

Glossary (3)

ACTION: a suit brought in a court; a formal complaint within the jurisdiction of a court of law.

ACTIONABLE: that for which an action will lie, furnishing legal ground for an action.

AFFIRM: to affirm a judgement of a lower court, a superior court declares that the judgement is valid and right and must stand as rendered below. To concur in its correctness.

AMICUS CURIAE: a brief, filed in a court action, by a party interested in the issues before the court, but who is not involved in the law suit.

BRIEF: a written statement prepared by the counsel arguing a case in court.

CAFC: Court of Appeals for the Federal Circuit. Formerly the CCPA.

CAUSE OF ACTION: the fact or facts which give a person a right to judicial relief.

CCPA: Court of Customs and Patent Appeals. Is equivalent to a U.S. court of appeals. Is superior to the PTBA and inferior to the Supreme Court.

CERTIORARI: a writ, issued by a superior court to an inferior court in order that the superior court may inspect the proceedings of a case adjudicated by the inferior court. A discretionary device used by the Supreme Court to choose the cases it will hear.

CLAIM: in a patent application, a written description of the invention to be patented.

CONTU: National Commission on New Technological Uses of Copyrighted Works.

CONVERSION: an unauthorized assumption and exercise of the right of ownership over goods or personal chattels belonging to another, to the alteration of their condition or the exclusion of the owner's rights.

DEFENDANT: the person defending or denying; the party against whom relief or recovery is sought in an action or suit.

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DEFENSE: that which is offered and alleged by the party proceeded against in an action or suit, as a reason in law or fact why the plaintiff should not recover or establish what he seeks.

DISTRICT COURT: trial courts with general federal jurisdiction. Each state has at least one district court. Only one judge is usually required to hear and decide a case in a district court.

ENJOIN: to require a person, by writ of injunction, to perform, or to abstain or desist from, some act.

FEDERAL REPORTER: a multi-volume series of books containing opinions of the federal courts including district courts, appeals courts, CCPA, claims court, and others.

FEDERAL SUPPLEMENT: a multi-volume series of books containing opinions of the following federal courts: district courts, claims court, and customs court.

FIDUCIARY: a person having duty, created by his undertaking, to act primarily for another's benefit in matters connected with such undertaking.

FINDING: the result reached by a judge or jury.

F. SUPP.: Federal Supplement.

F.2D: Federal Reporter, Second Series.

HOLDING: the legal principle to be drawn from the opinion (decision) of a court. The court's decision on a case.

IN CAMERA: a cause is said to be heard in camera either when the hearing is had before the judge in his private chambers or when all spectators are excluded from the courtroom.

INJUNCTION: a prohibitive remedy issued by a court at the suit of a party complaint, directed to a party defendant in the action, forbidding that party to do some act, or to permit his servants or agents to do some act, such act being unjust and inequitable, injurious to the plaintiff. A judicial process requiring the person to whom it is directed to do or refrain from doing a particular thing.

INTER ALIA: among other things.

JURISDICTION: areas of authority; the geographic area in which a court has power or types of cases it has power to hear.

LITIGATION: a lawsuit.

MERITS: referring to the strict legal rights of the
parties.

MOTION: an application made to a court or judge for purpose
of obtaining a rule or order directing some act to be done
in favor of the applicant.

MOVANT: one who makes a motion before a court.

OPINION: the statement by a judge or a court of the
decision reached in regard to a cause tried or argued
before them, expounding the law as applied to the case, and
detailing the reasons upon which the judgement is based.

PLAINTIFF: a person who brings an action; the party who
complains or sues in a civil action. A person who seeks
remedial relief for an injury to rights.

PER CURIAM: a phrase used to distinguish an opinion written
by the whole court from an opinion written by any one
judge. Sometimes it denotes a brief announcement of the
disposition of a case by court not accompanied by a written
opinion.

PRE-EMPTION: doctrine adopted by U.S. Supreme Court holding that certain matters are of such a national, as opposed to local, character that federal laws pre-empt or take precedence over state laws. As such, a state may not pass a law inconsistent with the federal law.

PRIOR ART: anything in tangible form that may properly be relied on by the patent office in patent cases in support of rejection of a patent application because the invention already exists.'

PTBA: Patent and Trademark Board of Appeals. The first level of legal appeals for patent application rejections. Is inferior to the CCPA.

PTO: Patent and Trademark Office; a federal agency in the Department of Commerce headed by the Commissioner of Patents and Trademarks that examines patent and trademark applications, issues patents, and registers trademarks.

RELIEF: a general designation of the assistance, redress, or benefit which a complainant seeks at the hands of a court.

REMAND: the sending by the appellate court of the cause back to the same court out of which it came, for purpose of having some further action taken on it there.

REMEDY: the means by which a right is enforced or the violation of a right is prevented, redressed, or compensated.

RESPONDENT: the party who contests and appeal or a motion.

REVERSAL: the annulling or setting aside by an appellate court of a decision of a lower court.

ROM: read only memory

S. Ct.: United States Supreme Court

SUMMARY JUDGEMENT: a rule of civil procedure that permits any party to a civil action to move for a summary judgement on a claim, counterclaim, or cross-claim when he believes that there is no genuine issue of material fact and that he is entitled to prevail as a matter of law.

TORT: a private or civil wrong or injury, other than breach of contract, for which the court will provide a remedy in the form of an action for damages.

TRIAL ON MERITS: trial of substantive issues in a case.
Term used in contrast to a hearing on motion or on other
interim matters.

TRIAL COURT: see district court.

TYING ARRANGEMENT: such exists when a person agrees to sell
one product the tying product, only on the condition that
the vendee also purchase another product, the tied product.

U.S.C.: United States Code: bound volumes containing
federal statutes

U.S.C.A.: United States Code Annotated; a multi-volume
publication containing the United States Code, together
with case notes of state and federal decisions which
construe and apply specific code sections, cross references
to related sections, historical notes, and library
references.

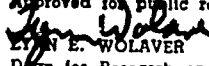WRONG: a violation of the legal rights of another.

VITA

Captain Richard A. Magnan was born on 27 August 1954
in Sacramento, California. He graduated from high school
in Chicopee, Massachusetts in 1976 and attended the
University of New Hampshire from which he received the
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computer system until entering the School of Engineering,
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Thesis Chairman: Gary Lamont, Ph.D.
Professor of Electrical Engineering

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DD FORM 1473, 83 APR EDITION OF 1 JAN 73 IS OBSOLETE.

The legal methods of protecting software are copyrights, patents, and trade secrets. An analysis of software protection is presented through a review of statute law and an analysis of copyright, patent, and trade secret court cases. The case analysis concentrates on the amount of technical information needed at trial, the court's handling of the technical data, and the changes in judicial decisions concerning the legal status of software. In addition, Air Force software procurement contract requirements are summarized. The report closes with conclusions about the available protection and with recommendations for improving software protection.